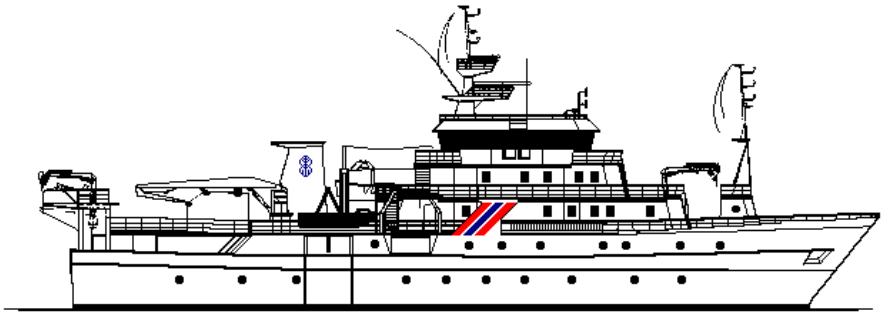

SURVEY OF THE PELAGIC FISH RESOURCES OFF NORTH WEST AFRICA

Part II

MAURITANIA
3 November - 13 November 2004

Institut Mauritanien de Recherches Océanographiques et des Pêches
Nouadhibou, Mauritania

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CRUISE REPORTS "DR FRIDTJOF NANSEN"

SURVEY OF THE PELAGIC FISH RESOURCES OFF NORTH WEST AFRICA

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by

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CHAPTER 1 INTRODUCTION

1.1 Objective of the cruise

The general objectives of the survey were to estimate biomass and map the distribution of the small pelagic fish stocks off NW Africa (Morocco, Mauritania, Senegal and the Gambia) by hydro-acoustic methods and describe the hydrographic conditions there over a period of 50 days, in November-December 2003. For Mauritania the agreed objectives were as follows:

- To map the distribution and estimate the biomass for the main small pelagic fish using hydro-acoustic methods. The species of interest were: sardinellas (*Sardinella aurita*) and (*Sardinella maderensis*), sardine (*Sardina pilchardus*) horse mackerels (*Trachurus trachurus*) and (*T. trecae*), false scad (*Decapterus rhonchus*), and anchovy (*Engraulis encrasicolus*) and chub mackerel (*Scomber japonicus*).

- To identify and describe the size distribution of the target fish populations by midwater and bottom trawl sampling and process the catches by recording weight and number by species.

- Collect biological data and otoliths of the main target species, especially *sardina pilchardus, Sardinella aurita, Sardinella maderensis* and *T. trecae*.

- To sample standard hydrographical transects for temperature, salinity and oxygen at every degree latitude, at about 17°00'N, 18°00'N, 19°00'N, 20°00'N and off Cape Blanc.

- To train local participants in acoustic survey methodology including fish identification and sampling, scrutinizing of echograms, acoustic abundance estimation and hydrographic sampling.

- To conduct a parallel survey with the Mauritanian research vessel Al Awam. This will include intercalibration and parallel trawling.

The time allocated for this part of the survey, off Mauritania, was 9 days.

1.2 Participation

Participating scientists were:

Institut Mauritanien de Recherches Océanographiques et des Pêches (IMROP), Mauritania:

Mamadou Sall Diallo, Abdoulaye Wagué (Team leader) , Jemal Ould Abed, Ibra Diallo

Centre de Recherches Océanographiques de Dakar-Thiaroye (CRODT), Senegal:

Abdoulaye Sarre

Department of Fisheries (FD), The Gambia:

Juldah Jallow

Institut National de Recherche Halieutique (INRH), Morocco:

Salaheddine Al Ayoubi

Institute of Marine Research (IMR), Norway:

Jens-Otto Krakstad (Cruise leader), Magne Olsen, Tore Mørk and Jan Frode Wilhelmsen

1.3 Narrative

The vessel departed from Dakar 18:00 GMT on the 03rd November and steamed north to start the survey at the border between Senegal and Mauritania at St. Louis (16°00'N). The survey started off St. Louis at 07:00 GMT the next day together with the local Mauritanian R.V. "Al Awam". Both vessels followed the standardized survey outline used in Mauritania with systematic parallel course tracks spaced about 10 NM (nautical miles) apart, perpendicular to the depth isobaths. To cover the whole distribution area of pelagic fish, the shelf was covered from the 15 m isobath and offshore to the 500 m isobath. Trawling was done irregularly, either to identify echo registrations or to check 'blindly' if fish were mixed with the plankton in the upper layers of the water column. Pelagic trawl with floats was often used to catch fish close to the surface. A smaller pelagic trawl or the bottom trawl with floats was used for sampling pelagic fish in very shallow waters (depth less than 25 m).

The shelf and slope was covered from St. Louis at the border between Senegal and Mauritania to Cape Blanc. The vessel reached Cape Blanc and the end of the regular survey 11th November 18:30 GMT. The vessel then steamed to Nouakchott where the survey was completed on the 13th November at 17:00 GMT.

Course track and fishing stations are shown in Figure 1, while Table 1 show survey effort during the survey, including number of trawl stations and CTD casts. All data collected during the survey were made available to the participants.

Five transects with hydrographic profiles were carried out, at 17°00' N, 18°00'N - at Nouakchott, 19°00' - south of Cape Timiris, 20°00'N outside Banc D'arguin, and at 20°50' N - Cape Blanc.

Table 1. Summary of survey effort by regions, including number of demersal (BT) and pelagic (PT) trawl hauls, CTD casts, and distance surveyed (log), disregarding the steaming from Cape Vert to St. Louis and from Cape Blanc to Nouakchott (log).

Area	BT	PT	Total trawls	CTD casts	Log (nm)
St. Louis to Cape Blanc	14	22	36	57	1386

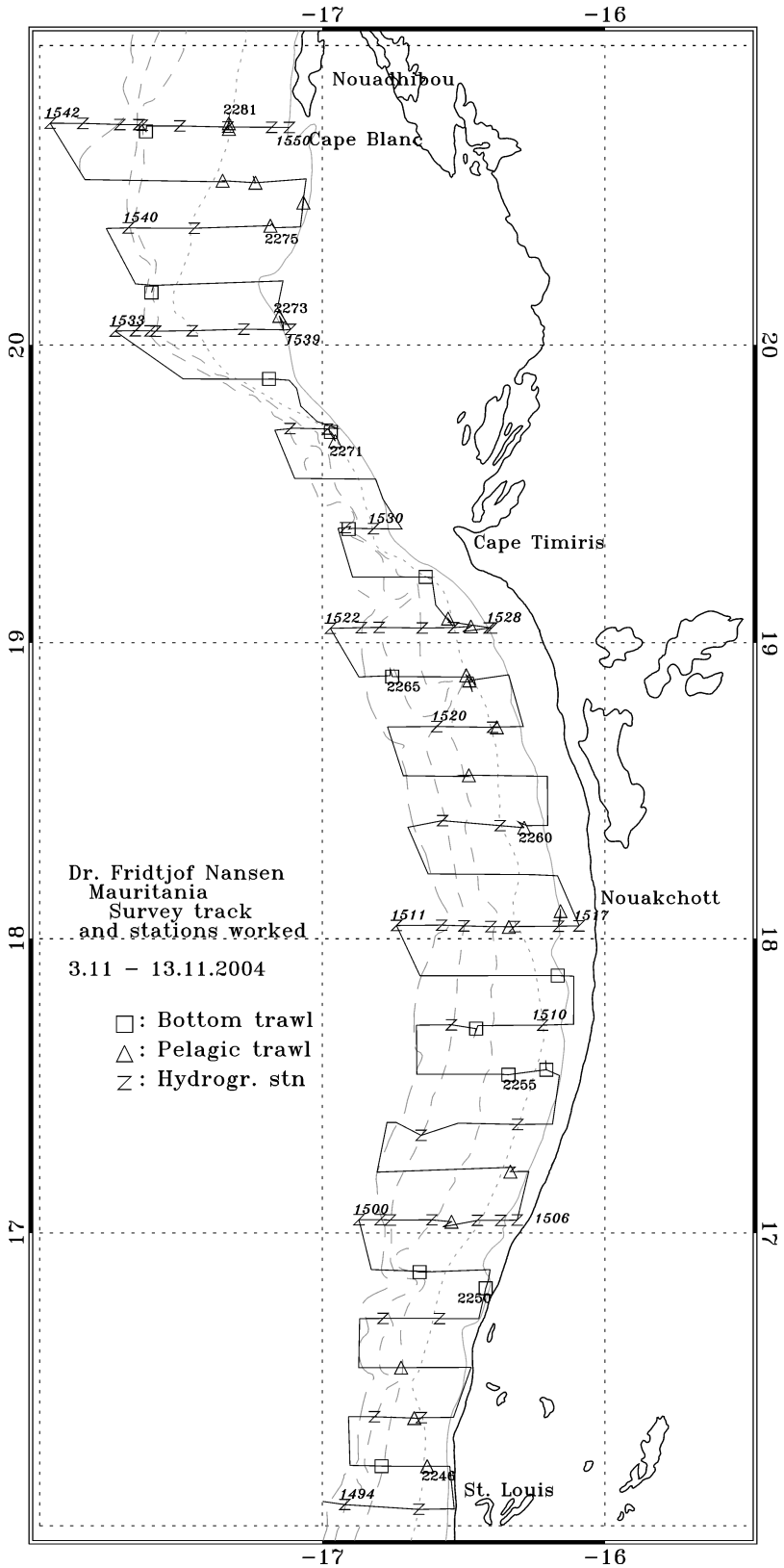


Figure 1. Course tracks with fishing and hydrographic stations; St. Louis to Cape Blanc

CHAPTER 2 METHODS

2.1 Environmental Data

A Seabird 911+ CTD probe was used to obtain vertical profiles of the temperature, salinity and oxygen. Real time logging was carried out using the PC based Seabird Seasave software. CTD casts were conducted along the cruise track in transects at about every one degree latitude at 15 m - 20 m, 50 m, 100 m, 200 m, 500 m, 750 m and 1000 m bottom depth, and at fixed stations every 50 m and 200 m depth every 20 NM. The casts were stopped a few meters above the bottom, and at a maximum of 500 m depth. Two water samples, one near the surface and the other near the bottom, were collected using *Niskin* bottles at stations corresponding to the standard profiles. The samples were analysed for dissolved oxygen using the Winkler method in order to calibrate the oxygen sensor. Salinity of water samples was used to calibrate the salinity sensor using the Guildline Portasal salinometer. The salinity sensor on the CTD was stable and it was not necessary to apply any correction factor.

A total of 22 samples were accepted for oxygen calibration on 26th October 2004. A linear regression of the Winkler determinations on the CTD values produced the correction:

$$O_{2corrected} = a \cdot O_{2recorded} + b \qquad (1)$$

were a=1.2498 and b=-0.0622

Sea surface salinity and relative temperature was continuously measured using a SBE 21 Seacat Thermosalinograph.

Meteorological data logged from the Aanderaa meteorological station included wind direction and speed, air temperature, incident solar intensity and sea surface temperature (SST). All data were averaged by unit distance sailed (1 NM).

2.2 Biological sampling

Biological sampling of the fish was carried out using trawls. A pelagic trawl with floats was often used. A smaller pelagic trawl or the bottom trawl with floats was used for sampling the pelagic fish in very shallow waters (depth less than 25 m). Annex II gives a description of the

instruments and the fishing gear used. All catches were sampled for composition by weight and numbers of each species caught. Species identification was based on the FAO Species Guides. Length frequency distributions, by total fish length in cm, of the selected target species were taken in all the stations where they were present. Individual weight measurements were taken regularly to estimate the condition factor in the length-weight relationship:

$$\overline{w} = \frac{cond}{100} \cdot L^3$$

The specific condition factors obtained from the samples and applied for this survey were: 0.96 for sardinellas and horse mackerels.

For the estimation of the biomass of carangids and associated species, an overall average length of 23 cm and a condition factor of 0.88 (to calculate the mean length of this length group) were applied. The target groups used for Mauritania can be found in Table 2, while the complete records of fishing stations and catches are shown in Annex I.

Table 2. Allocation of acoustic densities to taxii. Note that for the groups of sardinella, horse mackerel, and pilchard all encountered species are listed, while only examples are listed for the remaining groups.

Group	Taxon	Species
Sardinella	*Sardinella* sp.	*S. aurita* *S. maderensis*
Horse mackerel	*Trachurus* sp.	*T. trecae* *T. trachurus*
Sardine	Sardinops	*S. pilchardus*
Pelagic species 1	Clupeiformes$_1$	*Ilisha africana* *Engraulis encrasicolus*
Pelagic species 2	Carangidae$_2$	*Selene dorsalis* *Chloroscombrus chrysurus* *Decapterus rhonchus* *Alectis alexandrinus*
Little tuny	Scombridae	*Euthynnus alletteratus* *Sarda sarda* *Scomber japonicus*
	Sphyraenidae	*Sphyraena guachancho*
	Others	*Trichiurus lepturus* *Zeus faber*
Other demersal species	Sparidae$_3$	*Dentex angolensis* *D. macrophthalmus* *D. congoensis* *D. canariensis* *D. barnardi* *Pagellus bellottii* *Sparus caeruleostictus* *S. pagrus africanus*
Big-eye grunt	Other taxii	*Pseudupeneus prayensis* *Brachydeuterus auritus* *Arioma bondi* *Pomadasys incisus* *Galeoides decadactylus*
Mesopelagic species	Myctophidae$_3$ Other mesopelagic fish	
Plankton	Calanoidae Euphausiidae Other plankton	*Calanus* sp. *Meganyctiphanes sp.*

$_1$: other than *Sardinops* sp.; $_2$: other than *Trachurus* sp.; $_3$: main taxon in group.

2.3 Acoustic sampling

A SIMRAD EK500 Echosounder was used with the settings as shown in Annex II. All four frequencies 18 kHz, 38 kHz, 120 kHz and 200 kHz were logged. All abundance estimation was based on data from the 38 kHz transducer. The Bergen Integrator (BEI) was used for analysis and allocation of the integrated s_A-values to the individual specified target groups by 5 NM intervals. The allocation of values to target groups was based on a combination of a visual scrutiny of the behaviour pattern as deduced from echo diagrams, the BEI analysis, and the catch compositions.

In cases were the target category of fish contains more than one species (sardinellas and horse mackerels), the mean s_A-value allocated to the category is divided between the species in the same ratio as their contribution to the mean back scattering strength in the length frequency samples.

The following target strength (TS) function was applied to convert s_A-values (mean integrator value for a given species or group of species in a specified area) to number of fish:

$$TS = 20 \log L - 72 \text{ dB}$$

Which can be converted (see Toresen *et al*. 1998 for details) to the area form (scattering cross sections of acoustic targets):

$$C_{Fi} = 1.26\ 10^6\ L^{-2}$$

where L is total length in 1 cm length group *i* and C_{Fi} (m^{-2}) is the reciprocal back scattering strength, or so-called fish conversion factor. In order to split and convert the allocated s_A-values (m^2/NM^2) to fish densities (numbers per length group per NM^2), the following formula was used:

$$\rho_i = s_A \cdot \frac{p_i}{\sum_{i=1}^{n} \frac{p_i}{C_{F_i}}}$$

were

ρ_i = density of fish in length group *i*

s_A = mean integrator value

p_i = proportion of fish in length group *i*

$\sum_{i=1}^{n} \frac{p_i}{C_{Fi}}$ = the relative back scattering cross section (m^2) of the length frequency sample of the target species, and

C_{fi} = reciprocal back scattering cross section (σ_{bs}^{-1}) of a fish in length group *i.*

The integrator outputs were split in fish groups using a combination of behaviour pattern as deduced from echo diagrams, the BEI analysis and catch composition as described below. The following groups were used for Senegal: 1) sardinellas, 2) horse mackerels, 3) carangids and associated species, and 4) demersal fish.

The above equations show that the conversion from s_A-values to number of fish is dependent on the length composition of the fish. It is therefore important to get representative length distributions from the stock in the whole distribution area.

When the size classes (of e.g. young fish and older fish) are well mixed, the various length distributions can be pooled together with equal importance. Otherwise, when the size classes are segregated, the total distribution area has to be post-stratified, according to the length distributions, and separate estimates are made for the regions containing fish with equal size.

For a region representing a distribution of a target-specie, the following basic data are needed for the estimation of abundance;

1) the average s_A-value for the region,
2) the surface (usually square nautical miles, NM^2), and
3) a representative length distribution of the fish in the region.

If the targeted fish is a mixture of more than one species, for example sardinellas, a representative distribution of the two, within the region, as shown in the trawl catches, are used. A length distribution representing the number of the two species for each catch will have to be calculated. Thereafter, these distributions have to be normalized to a unit number (usually 100) so they are equally weighted.

A systematic approach to a) divide the s_A-value between species in a category of fish (e.g. *Sardinella aurita* and *S. maderensis*), b) produce pooled length distributions of a target species for use in the above equation and c) calculate the biomass estimates for a region, is obtained through the following procedure:

The samples of the species in the category (e.g. sardinellas) are respectively pooled together with equal importance (normalized).

The mean back scattering strength (ρ/s_A) of each length frequency distribution of the target species is calculated and summed. This is automatically done in the Excel spread-sheet made available for acoustic abundance estimation onboard RV “Dr. Fridtjof Nansen”, provided the data are punched in this sheet.

The mean s_A-value allocated to the category of fish in the region is divided between the species in the same ratio as their relative contribution to the mean back scattering strength of the length groups in the sample representing the region

The pooled length distribution is used, together with the mean s_A-value, to calculate the density (numbers per square NM) by length groups and species, using the above formula. The total number by length group in the area is obtained by multiplying each number by the area. The numbers are then converted to biomass using the estimated weight at length.

2.4 Parallel survey with R.V. "Al Awam"

During the survey the Mauritanian research vessel "Al Awam" did a parallel survey with "Dr. Fridtjof Nansen". As part of this, parallel trawl hauls were conducted with regular intervals, as well as acoustic intercalibration between the vessels. The strategy for the intercalibration followed the recommendations by MacLennan and Simmons (1992).

One of the research vessels placed itself 0.5 NM behind and 0.5 NM to the side of the vessel that took the lead. The distance between the vessels were chosen so that the vessels could stay as close together as possible without disturbing each other's acoustic recordings. Starting time and log were recorded onboard each vessel and the distance between vessels was kept constant during the experiment.

All data collected during the parallel survey and intercalibration will be analysed on land and a separate report will be produced on the exercise.

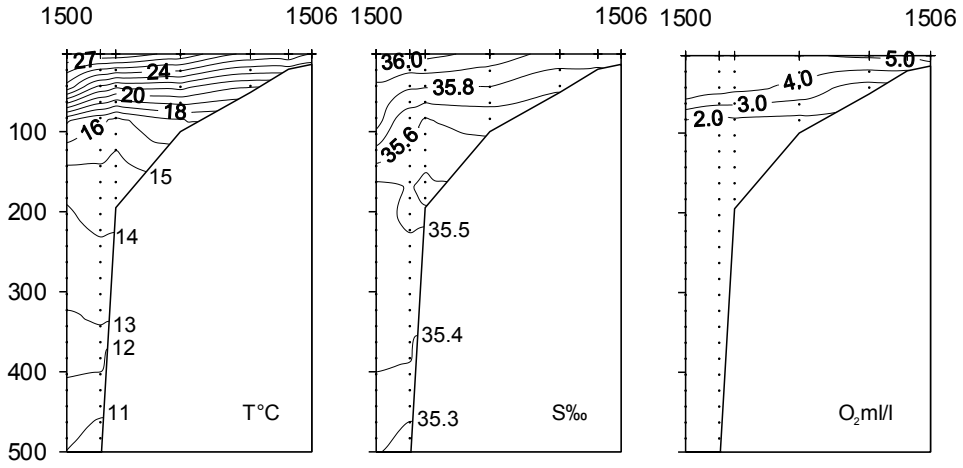
CHAPTER 3 SURVEY RESULTS

3.1 Hydrography

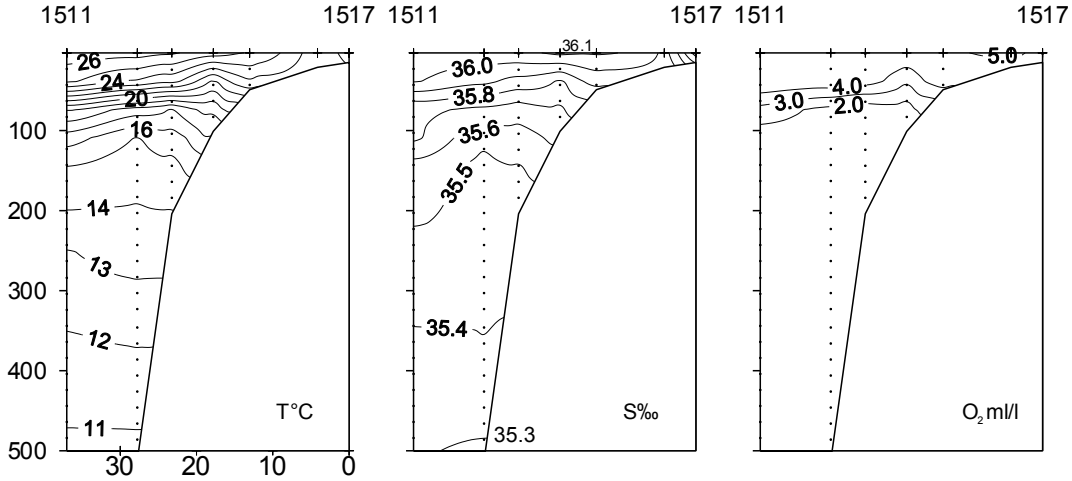
Hydrographical data was collected on fixed CTD stations to 500 m depth and from the Aanderaa weather station that continuously collect sea surface temperature, wind speed and direction, solar radiation etc. during the survey.

Cross shelf hydrographical profiles

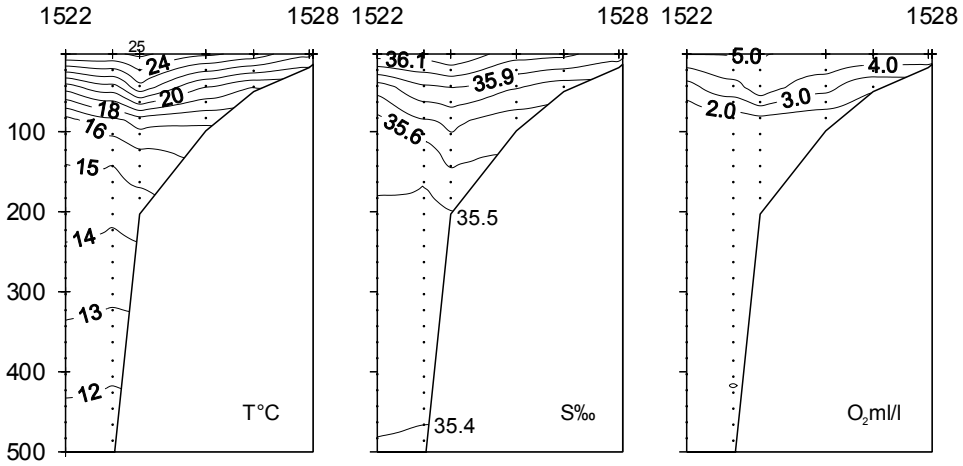
Figure 2 shows the distribution of temperature, salinity and oxygen from the five hydrographical transects collected during the survey. Typically, the surface waters showed an increase in water temperature from the coast and offshore. A gradual decrease in water temperature characterises the upper 80 m of the water column. The decrease in water temperature was less rapid below this, with the lowest temperatures found along the bottom, temperatures around 11°C was measured at 500 m depth. No typical thermocline was present along the hydrographical transects. The water masses became colder and more mixed with a less defined thermocline northwards along the Mauritanian coast, with a surface temperature of 23°C offshore at Cape Blanc. The surface waters show relatively high salinity, around 36 ‰ in the offshore waters, with decreasing salinity towards the coast. More turbulent water masses are present in the northern part of the region around Cape Blanc. All the CTD transects show well oxygenated waters, with approximately 5 ml/l O_2 in the surface water, declining to 2 ml/l O_2 at approximately 70 m depth.



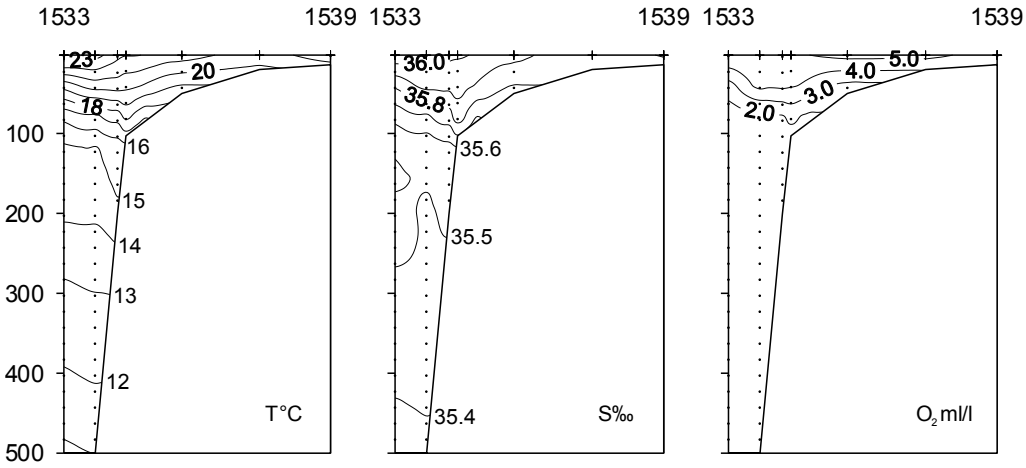
17°00'N



18°00'N **Nouakchott**



19°00'N



20°00'N

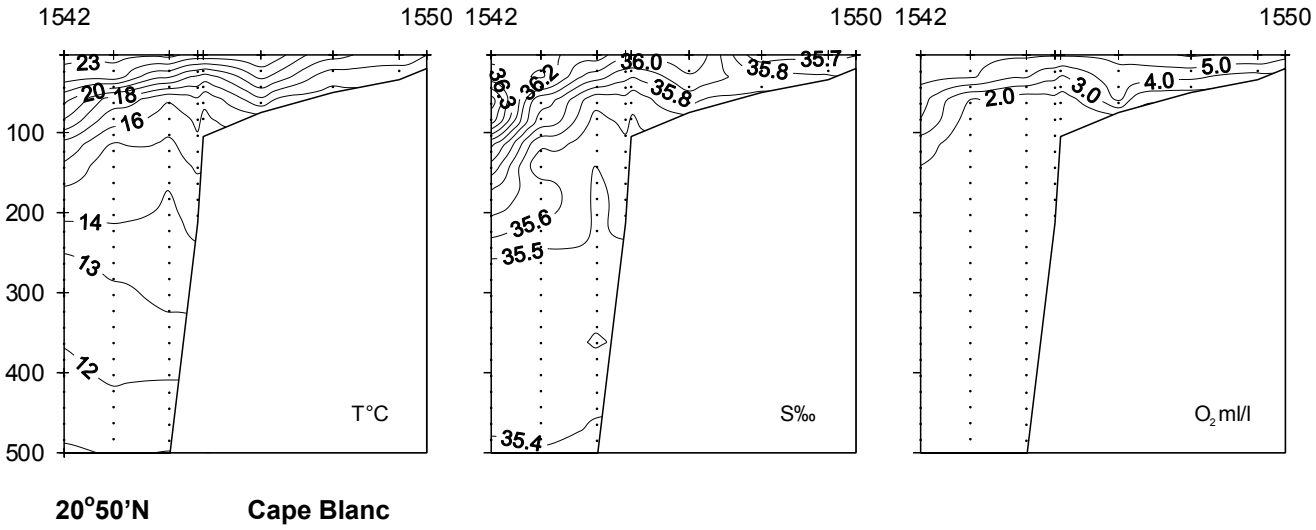


Figure 2. Hydrographical profiles with distribution of temperature, salinity and oxygen

Sea surface temperature and wind direction

Figure 3 shows the sea surface temperature at 5 m of depth while Figure 4 shows the sea surface salinity at 5 m depth. The southern part of Mauritania was characterized by relatively warm waters. The temperature isobaths were directed alongshore, with the coolest waters inshore and increasingly warmer temperature offshore, with a maximum of more than 27°C. North of Nouakchott temperature isobaths were running across shelf and a frontal zone is visible. However the waters are more turbulent again at Cape Timiris and warmer offshore water masses were brought into the shelf. In the north of the survey area a body of colder waters as low as 20°C was intruding into the Mauritanian shelf. And temperatures dropped with up to three degrees in less than 50 m surface distance at the border between the cold costal waters and offshore water masses. Water masses in the whole survey area were generally much warmer than last year, and cold water masses (20°C) were only present in the northern part of the survey area.

The sea surface salinity supports the picture seen from the sea surface temperature. Little variability in sea surface salinity is seen in the south of Cape Timiris and the salinity was stable around 35.9‰. North of this a body of less saline waters are seen at Cape Blanc with salinity around 35.5‰ corresponding with the cold water masses from the Canary current coming from north of the survey area.

Figure 5 show the wind direction and wind speed during the survey of Mauritania. The wind came from north and northwest in the southern part of the survey area. North of Nouakchott and around Cape Timiris more variable winds were experienced, with the wind direction often coming from northeast turning to southeast. Wind direction should be favourable for

upwelling in this area. At Cape Blanc the wind was stable from a northerly direction. The conditions were favourable for acoustic surveying throughout the survey.

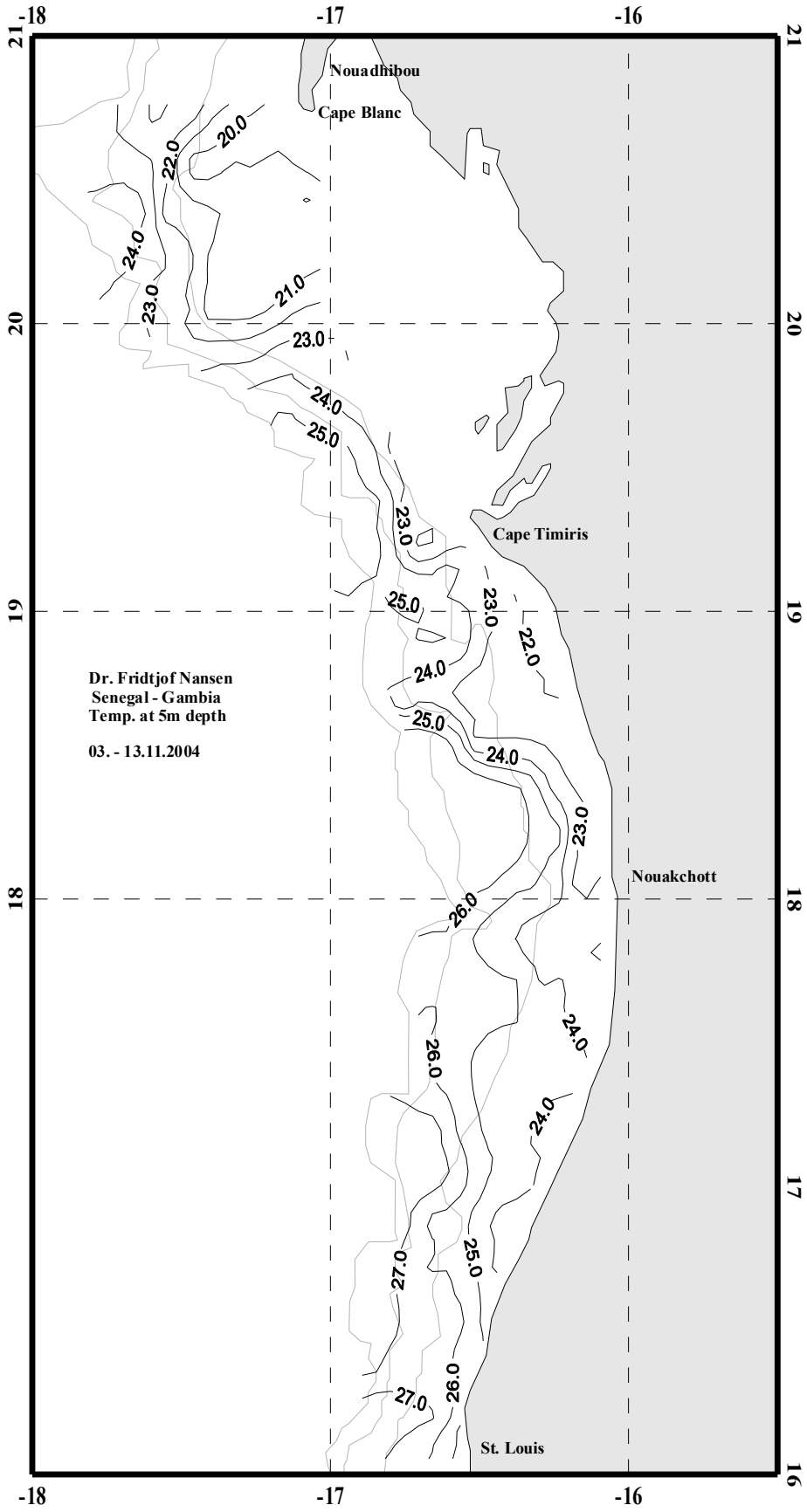


Figure 3. Sea surface temperature; St. Louis to Cape Blanc

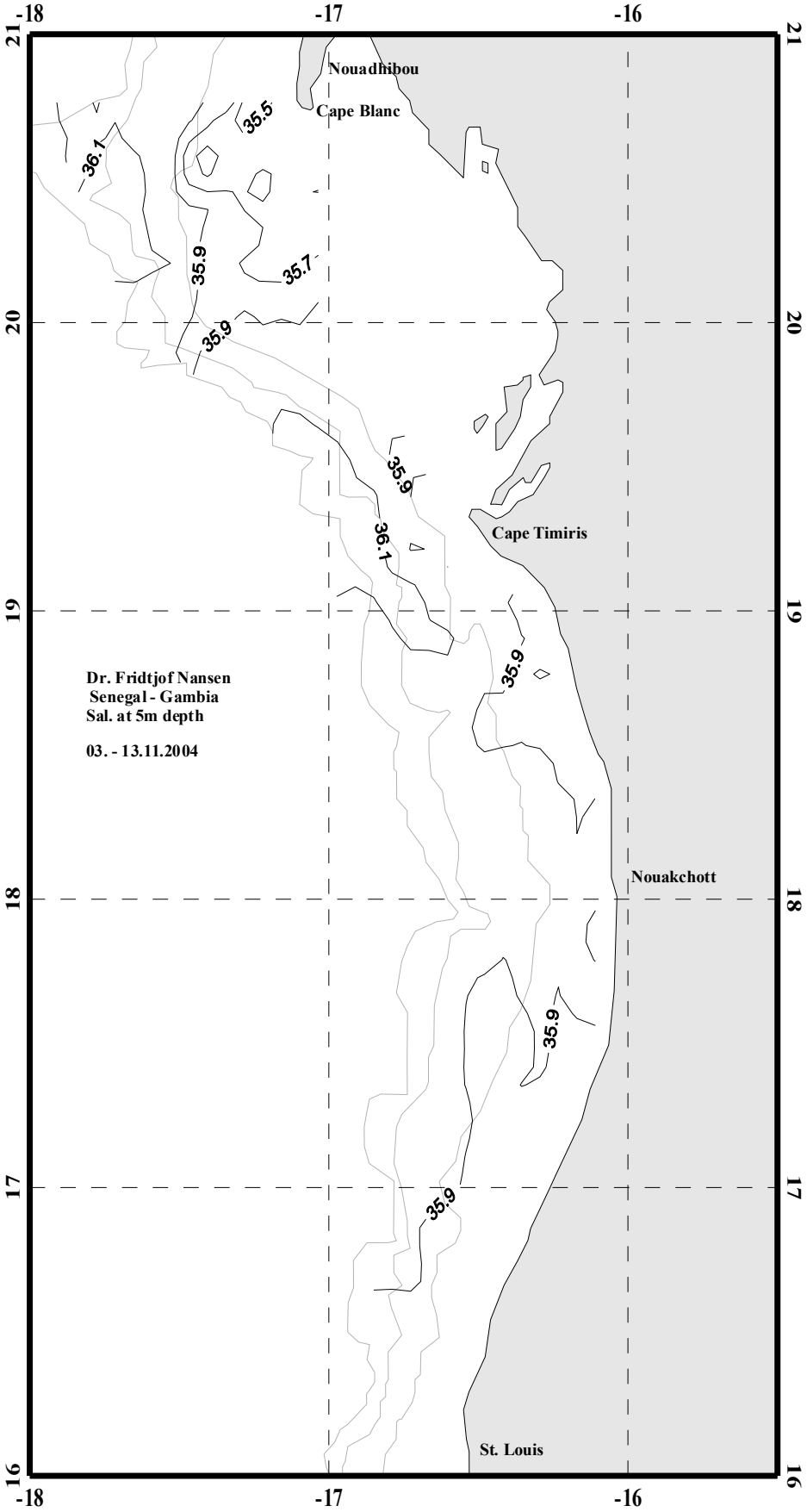


Figure 4. Sea surface salinity; St. Louis to Cape Blanc

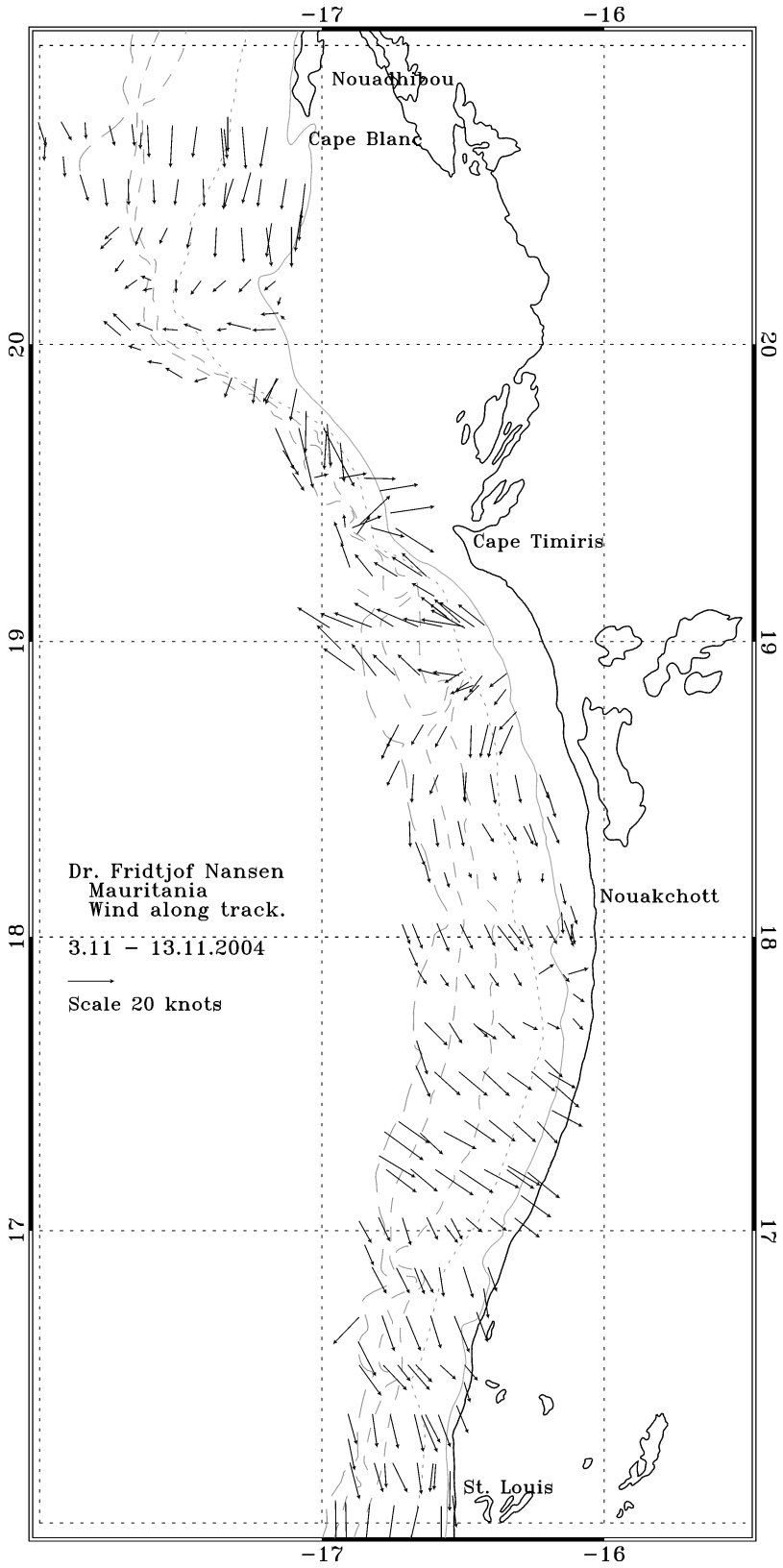


Figure 5. Wind speed and direction; St. Louis to Cape Blanc

3.2 St. Louis to Cape Timiris

The main groups of pelagic fish for the shelf of Mauritania illustrated with contoured acoustic densities are seen in Figure 6, Figure 7, Figure 8 and Figure 9.

Sardinella was found in two large distribution areas on the shelf between St. Louis and Cape Timiris, extending northwards into Banc D'arguin. The density was variable within each of the two main distribution areas, mainly with high to medium densities, and with low densities at the edge between the two main distribution areas. The sardinella was mainly distributed between the 15 m depth and offshore to more than 50 m depth, with highest concentrations found around 20 –30 m depth, Figure 6. Both species of sardinella were found in the area. The biomass of *S. aurita* was estimated to be 189 thousand tons, while the biomass of *S. maderensis* was estimated at 1 244 thousand tons.

Three modal peaks at 14 cm, 28 cm and 33 cm total length was observed for *Sardinella maderensis*, and more than 99% of the biomass was >20 cm. The modal size groups of *S. aurita* were 17 cm, 26 cm and 29 cm. Estimated number and biomass by length-groups are in Annex IV. The total biomass of sardinellas in the area was estimated at 1433 thousand tonnes, Table 3.

Trachurus trecae were found in five low-density areas between St. Louis and Cape Timiris, mainly between 50 m and 200 m depth. The highest concentrations were generally found at the shelf break close to the bottom, Figure 7. Horse mackerel was also occasionally found dispersed further inshore, mainly mixed with plankton and other pelagic species. A few catches of *Trachurus trachurus* were made offshore south of Cape Timiris. The biomass of *Trachurus trecae* in the area was estimated to be 29 thousand tons, while 0.8 thousand tons of *Trachurus trachurus* were found. No separate estimate of *Decapterus rhonchus* was made. The *Trachurus trecae* showed two modal peaks, at 13 cm and 23 cm roughly corresponding to one and three year old fish.

One catch of sardine (*Sardina pilchardus*) were made in shallow waters south of Cape Timiris. The modal length of the sardine in the catch was 25 cm. A few schools were found concentrated in this area, and the abundance was estimated to be 20 thousand tonnes.

Anchovy (*Engraulis encrasicolus*) were not found south of Cape Timiris

Other pelagic fish were found in low concentrations over large parts of the shelf. The main concentrations were between 50 and 20 m bottom depth, Figure 9. The P2's were rarely

distributed further offshore than the 100 m isobath. In general both carangids other than horse mackerel, scombrids, hairtails and barracudas were found in the area, Table 4. The catches were dominated by *Decapterus rhonchus, Trichiurus lepturus*, *Brachydeuterus auritus*, and *Selene dorsalis*. The species were well mixed with the sardinellas and horse mackerel in the areas were their distribution overlapped. The estimated biomass of this group of fish was 106 thousand tonnes. This includes *Decapterus rhonchus* which often has been estimated separately. However it was not possible this year to distinguish this species from the rest of the Carangid species in the region.

Table 3. St.Louis – Cape Timiris. Biomass estimates of pelagic fish, thousand tonnes.

S. maderensis	*S. aurita*	*Sardina pilchardus*	Horse mackerels	Carangids etc.
1244	189	20	29.8	106

Table 4. Catch by stations sorted by groups (in kg/hour) St. Louis – Cape Blanc

STA	TDEP	Clupeids	Carangids	Scombrids	Hairtails	Barracudas	Other
2246	18	266.1	121.6	20.2	0.0	5.6	181.1
2247	98	19.8	470.5	0.0	0.0	0.0	117.3
2248	19	605.3	141.7	0.0	29.4	8.7	73.7
2249	18	37.8	1827.0	0.0	31.6	0.0	4.1
2250	20	296.5	131.8	0.0	66.3	0.7	1779.1
2251	85	0.0	38.1	0.0	3.9	0.0	29.0
2252	28	14.9	27.9	0.0	11.8	0.0	1.0
2253	19	0.0	48.8	0.0	5.0	1.2	1595.1
2254	38	0.0	26.3	0.0	0.0	1.5	329.7
2255	79	12.3	226.4	0.0	364.0	0.0	2135.9
2256	119	0.0	125.3	0.0	111.3	0.0	193.4
2257	22	0.0	46.4	0.0	0.0	0.0	1799.7
2258	19	19.0	5.0	0.0	83.3	0.0	54.0
2259	10	8.9	91.6	0.0	3.1	0.0	101.3
2260	10	304.2	54.8	6.2	0.0	0.0	91.5
2261	5	0.0	161.0	0.0	294.9	0.0	189.1
2262	17	0.0	35.8	0.0	14.5	0.0	645.3
2263	28	1.1	0.5	0.0	0.0	0.0	0.0
2264	23	26.6	22.1	0.0	0.0	0.0	0.0
2265	223	0.0	35.2	0.0	85.8	0.0	2493.5
2266	10	1664.9	187.7	0.0	2.5	0.0	38.2
2267	25	77.8	39.8	28.1	30.9	0.0	8.2
2268	65	0.0	0.0	0.0	73.9	0.0	591.2
Mean	43.4	145.9	168.0	2.4	52.7	0.8	541.4

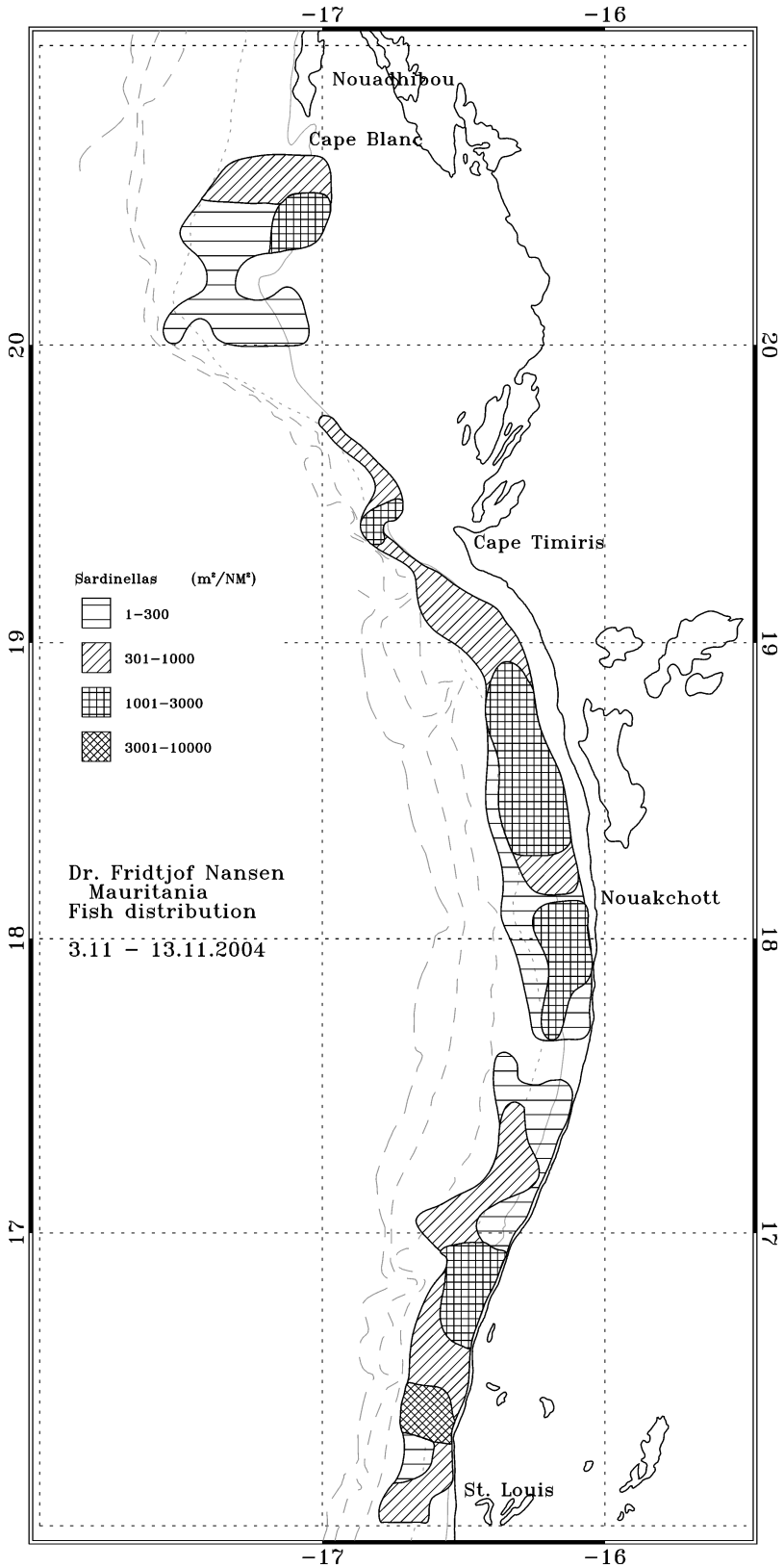


Figure 6. Distribution of sardinellas; St. Louis to Cape Blanc

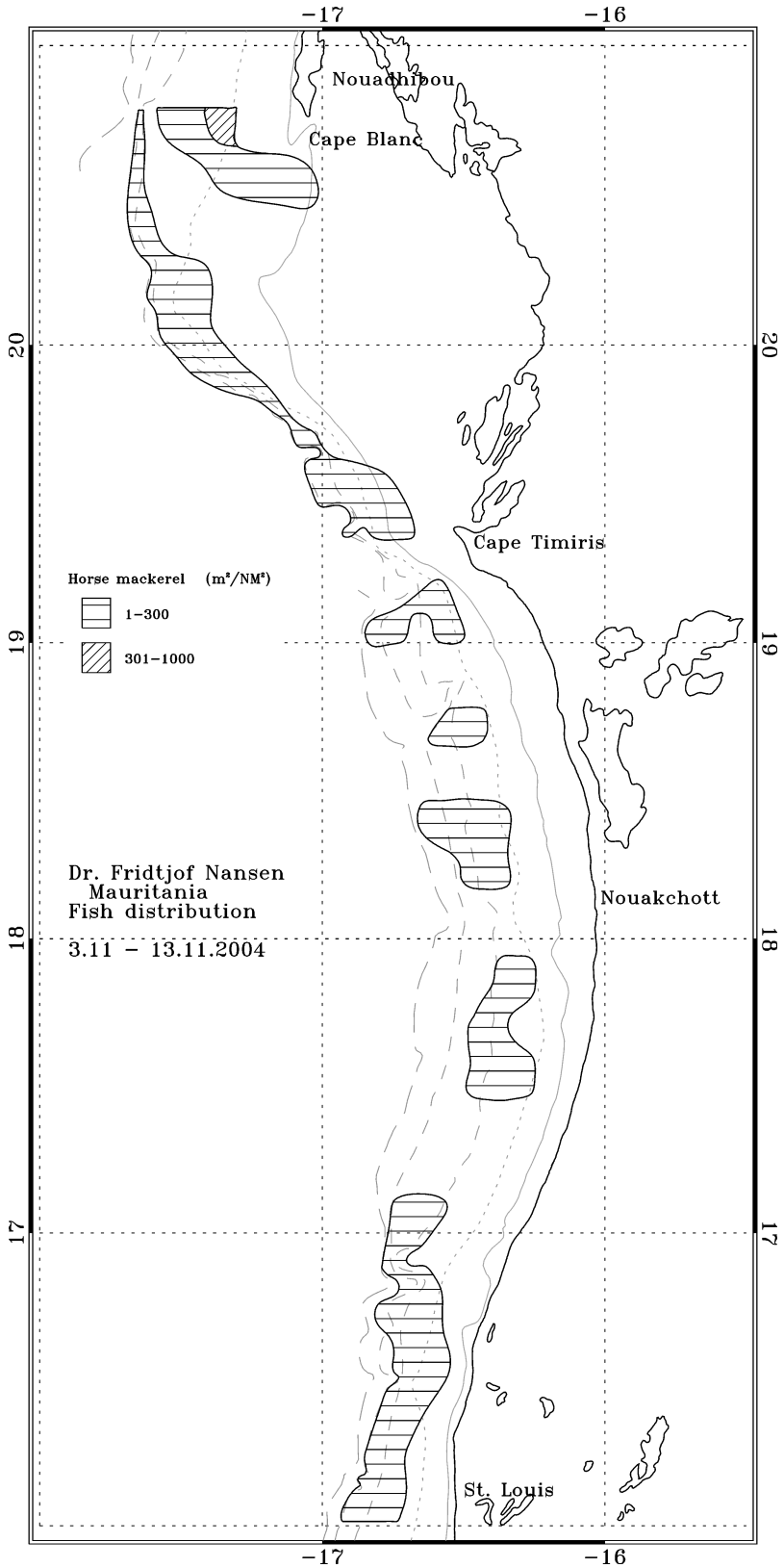


Figure 7. Horse mackerels; St. Louis to Cape Blanc

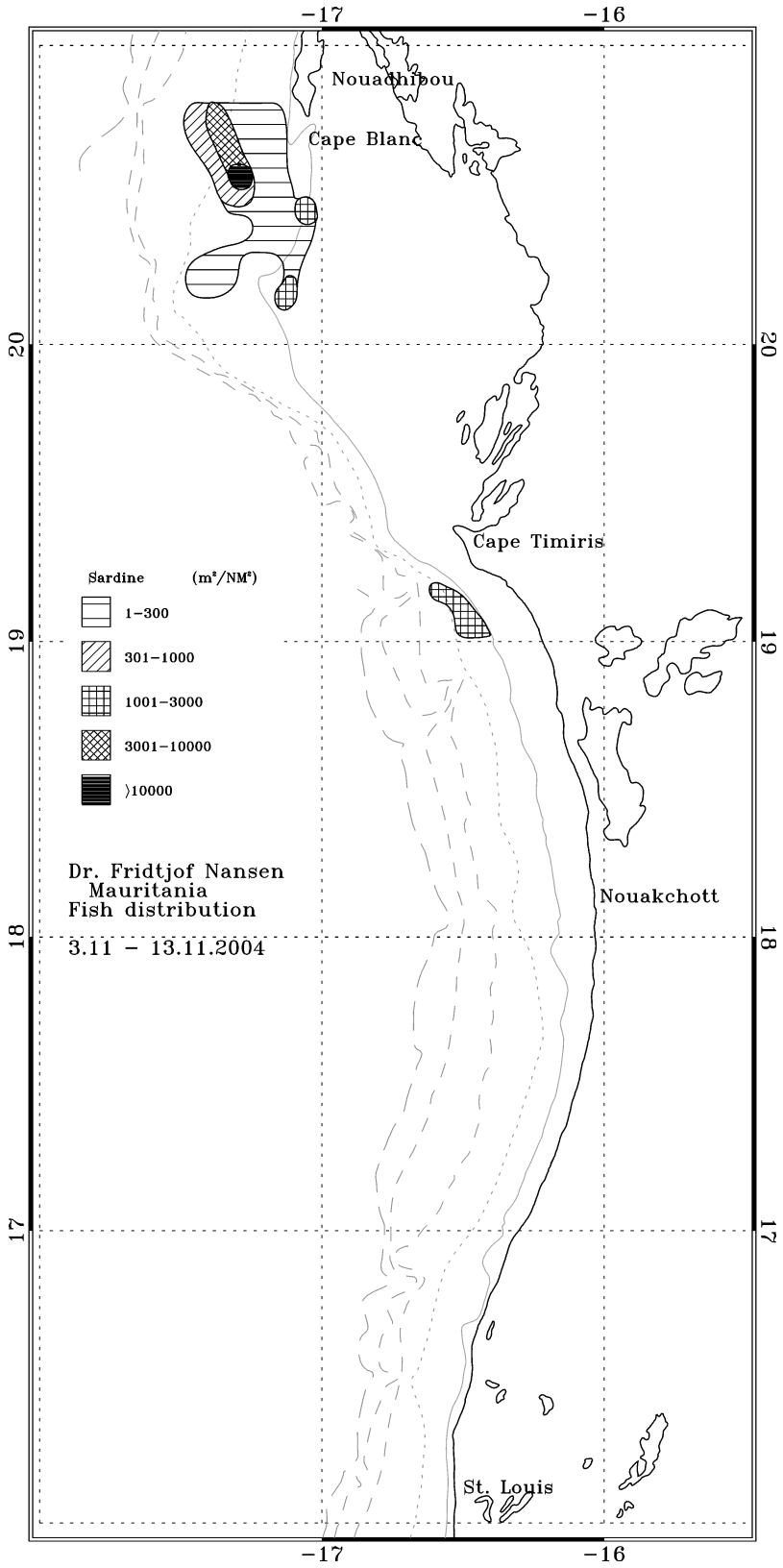


Figure 8. Sardine, St. Louis to Cape Blanc

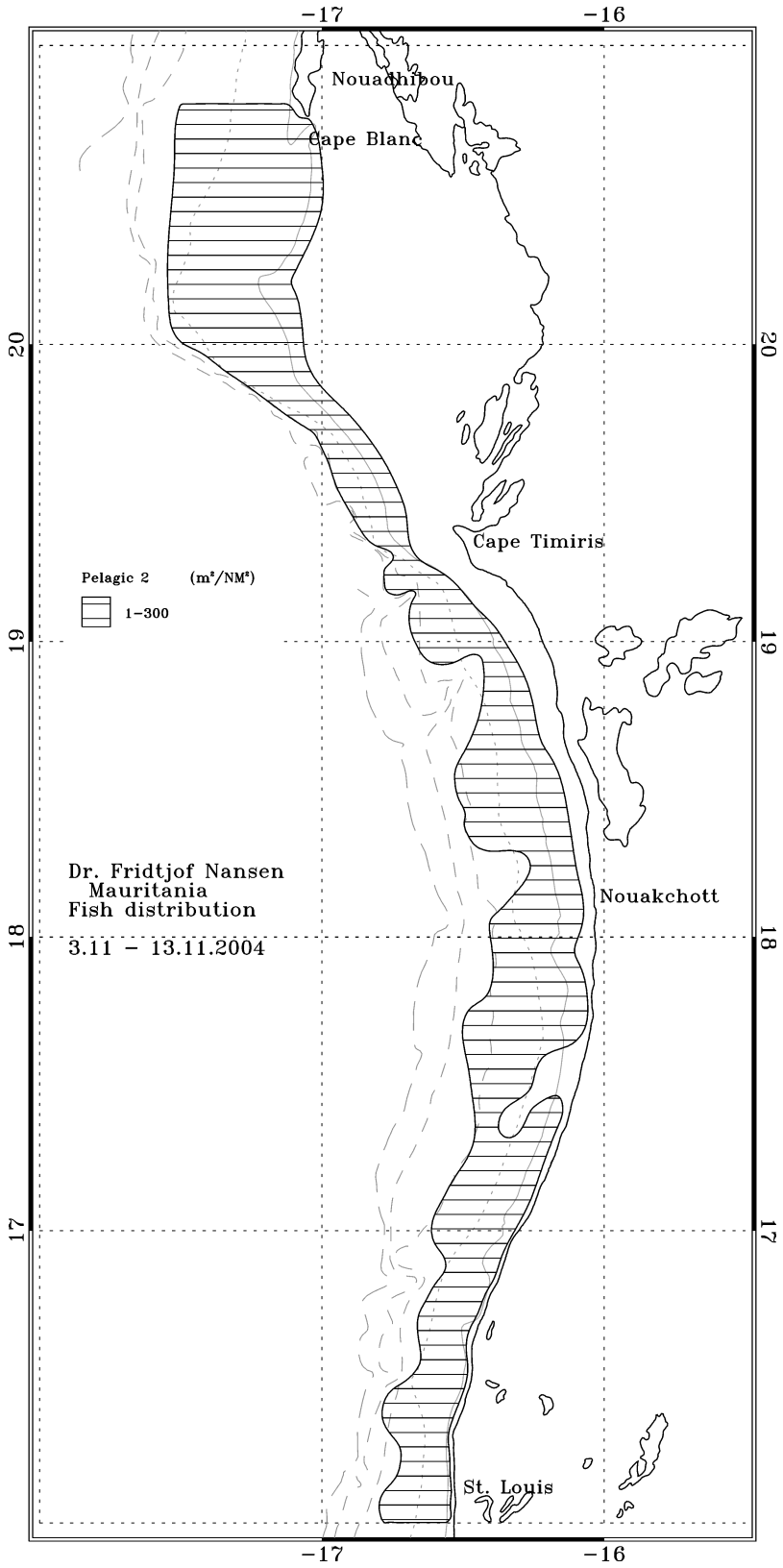


Figure 9. Carangids and associated species; St. Louis to Cape Blanc

3.3 Cape Timeris – Cape Blanc

Both species of sardinellas were found on the shelf at Cape Blanc from less than 20 m depth to the 50 m isobath, Figure 6. The highest concentrations were found in the northernmost part of the area and inshore, and some sardinella was probably missed in the shallow part (<15 depth) of Banc D'arguin. The total estimate of sardinellas between Cape Timiris and Cape Blanc during this survey was 115 thousand tons, Table 5. This comprised of 91 thousand tons of *S. maderensis* and 24 thousand tons of *S. aurita*. Similar to last year, mainly adults of *S. maderensis* were found in the area, with one modal peak visible at 22 cm. The *S. aurita* in the area showed two modal peaks at 8 cm and 23 cm. The estimated number and biomass by length-groups are in Annex IV.

Sardine (*Sardina pilchardus*) was found in high- very high concentrations south of Cape Blanc, extending northwards. Highest concentrations were found around 50 m depth, Figure 8. The biomass of sardine in this area was estimated to be 384 thousand tons, Table 5. This consisted of one cohort with adult fish, with a modal peak at 25 cm.

Anchovy (*Engraulis encrasicolus*) were found in two trawl samples at night south of Cape Blanc in shallow waters, <50 m depth. No attempt was made to estimate the biomass.

Cunene and Atlantic horse mackerel was found mixed in one area from Cape Blanc and southwards on the shelf and shelf break to Cape Timiris around 100 m depth, while another area inshore off Cape Blanc consisted of Cunene horse mackerel only, Figure 7. *Decapterus rhonchus* was found further north than usual due to the warmer than normal water conditions. The species was thoroughly mixed with other pelagic species, hence no separate estimate was made and the biomass included as part of the P2. The estimated biomass of horse mackerels in the area were 53 thousand tons, Table 5. The biomass estimate comprised of 45 thousand tons of *Trachurus trecae* and eight thousand tons of *T. trachurus*. The biomass of *T. trecae* consisted mainly of juveniles, with a modal peak of 12 cm, while *T. trachurus* in the area showed a modal peak at 26 cm. Some few adult *T. trecae* with a modal peak around 41 cm was also found on the shelf break. The estimated number and biomass by length-groups can be found in Annex IV.

Carangids and associated species were found in low density across the shelf in the whole area between Cape Timiris and Cape Blanc, Figure 9. Hairtails, *Trichiurus lepturus*, dominated the group by weight, but *Decapterus rhonchus* and *Chloroscombrus chrysurus* were also frequent in the catches on the shelf. The biomass estimate of this group was 42 thousand tons, Table 5.

Table 5. Cape Timiris – Cape Blanc. Biomass estimates of pelagic fish, thousand tons.

S. maderensis	*S. aurita*	*Sardina pilchardus*	Horse mackerels	Carangids etc.
91	24	384	53	42

Table 6. Catch by stations sorted by groups (in kg/hour) Cape Timiris – Cape Blanc

STA	TDEP	Clupeids	Carangids	Scombrids	Hairtails	Barracudas	Other
2269	98	0.0	1799.3	0.0	45.1	0.0	1122.6
2270	50	97.5	411.1	0.0	678.6	0.0	2327.0
2271	10	23.7	1089.3	3.4	222.0	0.0	39.1
2272	26	41.3	9.6	0.0	0.0	0.0	952.6
2273	10	174.4	741.9	0.0	0.0	82.8	76.5
2274	99	0.0	60.6	0.0	247.8	0.0	711.8
2275	10	2182.1	211.3	0.0	0.0	0.0	2809.4
2276	10	3422.5	114.5	0.0	0.0	0.0	1886.8
2277	19	399.5	9.0	0.0	0.0	0.0	3.6
2278	10	3263.7	3.0	0.0	16.8	0.0	28.2
2279	98	0.0	0.8	0.0	2.7	0.0	334.6
2280	10	0.0	0.0	9.9	0.0	0.0	750.0
2281	10	8.8	0.0	0.0	0.0	0.0	65.7
Mean	35.4	739.5	342.3	1.0	93.3	6.4	854.4

3.4 Parallel trawl survey

The parallel trawl survey was conducted successfully. During the survey of Mauritania the R.V. “Al Awam” followed the same course track as R.V. “Dr. Fridtjof Nansen”. As part of the parallel trawl survey several rounds of intercalibration were conducted successfully. The data from the parallel survey will be analysed later and presented in a separate report.

CHAPTER 4 OVERVIEW AND SUMMARY OF RESULTS

The survey was conducted successfully from 3rd to 13th November, covering a course track of approximately 1 386 NM. A total of 36 fishing stations and 57 CTD casts were established.

The hydrographical data showed warmer than usual surface temperatures over most of the Mauritanian shelf. Cold water (20°C) was only present in the northernmost part of the survey area around Cape Blanc, Figure 3. The southern part of Mauritania showed stable salinity levels around 35.9‰ while the cold water area around Cape Blanc had lower salinity levels around 35.5‰. The shelf was well oxygenated in the whole survey area.

Sardinellas were generally found along the whole shelf of Mauritania, between 15 m depth and offshore to approximately 50 m bottom depth, Figure 6. Similar to last year in November the bulk of the biomass was dominated by *S. maderensis* (86%). The majority of the biomass of both species was found south of Cape Timiris. North of this, only 24 thousand and 91 thousand tons of *S. aurita* and *S. maderensis* respectively, were found, Table 7. However, division of biomass between the two species of sardinella relies entirely on trawl samples. Sardinella shows strong trawl avoidance and some care should therefore be taken when interpreting the results at species level. The concentration area of sardinella south of Cape Blanc was on the inner part of the shelf. It is probable that some sardinella was distributed on the large shelf area inside of 15 m bottom depth, and therefore not found during the survey.

Sardine were found inshore in shallow waters in a small area at Cape Timiris, and in a larger distribution around the border area at Cape Blanc, extending across the border and following roughly the same distribution as the cold water intrusion from the north. The total biomass in Mauritanian waters were estimated to be 405 thousand tons

Cunene horse mackerel were found in several low-density areas all along the coast of Mauritania. The main part of the distribution was between 50 and 100 m depth, but some Cunene horse mackerel was also found inshore of the 50 m isobath. Small concentrations of Atlantic horse mackerel started to mix with the Cunene horse mackerel, mainly on the outer part of the shelf and the shelf break in the northern part of Mauritania, Figure 7. The total abundance estimate of Cunene horse mackerel was 74 thousand tons while the estimate of Atlantic horse mackerel was 9 thousand tons.

Other carangids and associated species were distributed over most of the shelf at rather low densities along the whole coast, Figure 9. The main species in the catches was *Trichiurus lepturus,* hairtails, while *Decapterus rhonchus* and *Brachydeuterus auritus* was frequently caught on the shelf south of Cape Timiris and *Decapterus rhonchus* and *Chloroscombrus chrysurus* dominated north of cape Timiris. The main groups of species in the catches can be found in Table 4. The total biomass was estimated at approximately 69 thousand tons, of this 51 thousand tons were found south of Cape Timiris.

An overview of the acoustic estimates of biomass of the main groups of pelagic fish is shown in Table 7, and the geographical distribution and abundance of main species is in Figure 10. The total biomass of sardinellas was thus 1 548 thousand tons, horse mackerels 83 thousand tons and of carangids and associated species 148 thousand tons. Note that *Decapterus rhonchus* has been included in the biomass of other Carangids (P2) as no biomass estimate was made for this group.

Table 7. Summary of biomass estimates of pelagic fish, Mauritania. thousand tons.

	Sardinella maderensis	*Sardinella aurita*	*Sardina pilchardus*	Horse mackerels	Carangids etc.
St. Louis – Cape Timiris	1244	189	20	30	106
Cape Timiris – Cape Blanc	91	24	384	53	42
Total	1335	213	404	83	148

The abundance of sardinella in Mauritanian waters has increased immensely since the very low estimate in November 2002 were only 320 tons of sardinella were found. This year's estimate is the highest since November 1995. The large increase in the biomass of sardinella may also explain the decrease in the biomass of horse mackerels and some of the other carangid species. The abundance of Cunene horse mackerel in particular is lower than it has been in many years.

The total estimate of carangids and associated species (including horse mackerel) was estimated at 231 thousand tons. This is low compared to last years estimate. There seems to be a downward trend in the biomass estimates of these species, which may have connection with the large increase of sardinella species in the region.

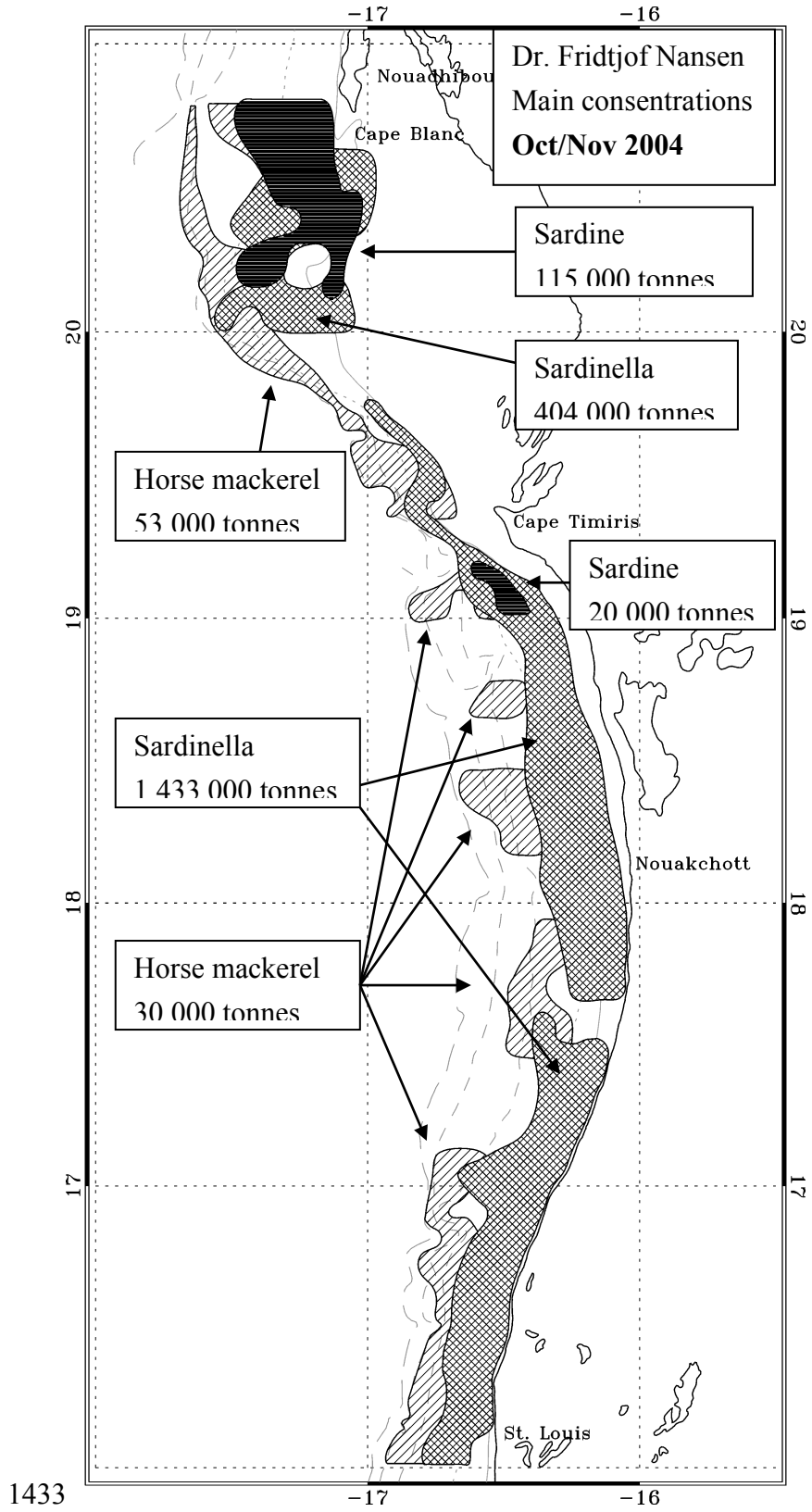


Figure 10. Major pelagic fish concentrations with estimated biomass (tonnes), Mauritania.

Table 8. Biomass estimates from 'Dr. Fridtjof Nansen' surveys of the Mauritanian shelf, thousand tons.

Survey:	Sardinellas	Carangids etc.
AprMay-81	20	370
Sept -81	75	*
FebMar -82	50	470
NovDec-86	300	540
FebMar-92	1 970	190
NovDec-95	1 780	190
NovDec-96	1 400	400
NovDec-97	1 200	660
NovDec-98	1 130	280
NovDec-99	740	560
NovDec-00	930	1 040
June -01	570	670
NovDec-01	230	370
June -02	930	1 130
NovDec-02	320	440
June - 03	890	620
Nov - 03	1 287	400
Nov - 04	1 548	231

* Not available

References

Toresen, R., Gjøsæter, H., and Barros, P. 1998. The acoustic method as used in the abundance estimation of capelin (*Mallotus villosus* Müller) and herring (*Clupea harengus* Linné) in the Barents Sea. Fisheries Research 34 (1998) 27-37.

MacLennan, D. N. and Simmons E. J. (1992). Fisheries Acoustics. Chapman and Hall.325p.

Annex I. Records of fishing stations

DR. FRIDTJOF NANSEN PROJECT:W3 PROJECT STATION:2246
DATE: 4/11/04 GEAR TYPE: PT No: 2 POSITION:Lat N 1612
start stop duration Long W 1638
TIME :12:44:00 13:07:24 23 (min) Purpose code: 1
LOG :8028.11 8029.64 1.52 Area code : 3
FDEPTH: 20 15 GearCond.code:
BDEPTH: 47 37 Validity code:
Towing dir: 90ø Wire out: 105 m Speed: 38 kn*10

Sorted: 82 Kg Total catch: 227.90 CATCH/HOUR: 594.52

SPECIES	CATCH/HOUR weight	numbers	% OF TOT. C	SAMP
Sardinella aurita	231.39	1372	38.92	3737
Rhizoprionodon acutus	91.57	76	15.40	
Chloroscombrus chrysurus	55.04	6274	9.26	
Selene dorsalis	48.52	762	8.16	
Stromateus fiatola	32.87	52	5.53	
Brachydeuterus auritus	29.48	389	4.96	
Sardinella maderensis	22.17	219	3.73	3738
Sphyrna lewini	18.26	13	3.07	
Alectis alexandrinus	18.00	34	3.03	
Ilisha africana	12.55	136	2.11	
Scomberomorus tritor	11.74	16	1.97	
Sarda sarda	8.48	16	1.43	
Pomadasys peroteti	6.52	83	1.10	
Sphyraena sphyraena	3.89	16	0.65	
Sepia officinalis hierredda	2.35	3	0.40	
Sphyraena guachancho	1.70	34	0.29	
Total	594.53		100.01	

DR. FRIDTJOF NANSEN PROJECT:W3 PROJECT STATION:2247
DATE: 4/11/04 GEAR TYPE: BT No: 8 POSITION:Lat N 1612
start stop duration Long W 1647
TIME :15:03:52 15:34:29 31 (min) Purpose code: 1
LOG :8044.23 8045.85 1.62 Area code : 3
FDEPTH: 101 94 GearCond.code:
BDEPTH: 101 94 Validity code:
Towing dir: 90ø Wire out: 340 m Speed: 31 kn*10

Sorted: 28 Kg Total catch: 313.92 CATCH/HOUR: 607.59

SPECIES	CATCH/HOUR weight	numbers	% OF TOT. C	SAMP
Trachurus trecae	470.52	18735	77.44	3739
Boops boops	22.78	1725	3.75	
Merluccius senegalensis	20.65	43	3.40	
Loligo vulgaris	20.01	85	3.29	
Sardinella aurita	19.80	341	3.26	
Zeus faber	17.88	170	2.94	
Illex coindetii	9.79	319	1.61	
Lagocephalus laevigatus	8.94	64	1.47	
Octopus vulgaris	6.77	10	1.11	
Pagellus bellottii	3.19	319	0.53	
GALATHEIDAE	2.77	532	0.46	
Todaropsis eblanae	2.34	106	0.39	
Syacium micrurum	0.85	21	0.14	
Alloteuthis africana	0.64	106	0.11	
GOBIIDAE	0.43	43	0.07	
Sepiella ornata	0.21	21	0.03	
Total	607.57		100.00	

DR. FRIDTJOF NANSEN PROJECT:W3 PROJECT STATION:2248
DATE: 4/11/04 GEAR TYPE: PT No: 2 POSITION:Lat N 1622
start stop duration Long W 1640
TIME :20:08:59 20:18:48 10 (min) Purpose code: 1
LOG :8082.53 8083.15 0.60 Area code : 3
FDEPTH: 20 17 GearCond.code:
BDEPTH: 63 59 Validity code:
Towing dir: 90ø Wire out: 150 m Speed: 41 kn*10

Sorted: 65 Kg Total catch: 143.13 CATCH/HOUR: 858.78

SPECIES	CATCH/HOUR weight	numbers	% OF TOT. C	SAMP
Sardinella aurita	604.50	3030	70.39	3740
Selene dorsalis	74.28	1188	8.65	
Trachurus trecae	54.30	408	6.32	3741
Brachydeuterus auritus	53.88	438	6.27	
Trichiurus lepturus	29.40	300	3.42	
Rhizoprionodon acutus	13.38	6	1.56	
Chloroscombrus chrysurus	11.58	78	1.35	
Sphyraena sphyraena	8.70	90	1.01	
Dentex canariensis	3.60	18	0.42	
Sepia bertheloti	1.98	90	0.23	
Decapterus rhonchus	1.50	18	0.17	
Pseudupeneus prayensis	0.90	18	0.10	
Sardinella maderensis - Juv.	0.78	48	0.09	
Total	858.78		99.98	

DR. FRIDTJOF NANSEN PROJECT:W3 PROJECT STATION:2249
DATE: 5/11/04 GEAR TYPE: PT No: 2 POSITION:Lat N 1632
start stop duration Long W 1643
TIME :01:42:50 02:12:57 30 (min) Purpose code:
LOG :8125.54 8127.58 2.01 Area code : 3
FDEPTH: 20 16 GearCond.code: 1
BDEPTH: 60 52 Validity code:
Towing dir: 90ø Wire out: 105 m Speed: 40 kn*10

Sorted: 44 Kg Total catch: 950.26 CATCH/HOUR: 1900.52

SPECIES	CATCH/HOUR weight	numbers	% OF TOT. C	SAMP
Trachurus trecae	1827.00	60410	96.13	3742
Sardinella aurita	37.80	630	1.99	
Trichiurus lepturus	31.60	170	1.66	
Loligo vulgaris	2.02	16	0.11	
Arius parkii	1.86	2	0.10	
Lagocephalus laevigatus	0.24	2	0.01	
Total	1900.52		100.00	

DR. FRIDTJOF NANSEN PROJECT:W3 PROJECT STATION:2250
DATE: 5/11/04 GEAR TYPE: BT No: 8 POSITION:Lat N 1649
start stop duration Long W 1625
TIME :08:26:11 08:54:47 29 (min) Purpose code: 1
LOG :8180.68 8182.50 1.82 Area code : 3
FDEPTH: 19 21 GearCond.code:
BDEPTH: 19 21 Validity code:
Towing dir: 17ø Wire out: 120 m Speed: 37 kn*10

Sorted: 59 Kg Total catch: 1099.25 CATCH/HOUR: 2274.31

SPECIES	CATCH/HOUR weight	numbers	% OF TOT. C	SAMP
J E L L Y F I S H	407.34	3441	17.91	
Sparus caeruleostictus *	353.01	1486	15.52	
Ilisha africana	277.34	6337	12.19	
Galeoides decadactylus	215.07	1883	9.46	
Drepane africana	162.93	254	7.16	
Arius parkii	121.30	579	5.33	
Pomadasys jubelini	104.28	652	4.59	
Decapterus rhonchus	72.41	399	3.18	
Trichiurus lepturus	66.25	327	2.91	
Rhinoptera marginata	64.45	21	2.83	
Pteroscion peli	63.00	906	2.77	
Leptocharias smithii	45.99	72	2.02	
Pseudotolithus senegalensis	43.10	37	1.90	
Chloroscombrus chrysurus	42.37	979	1.86	
Pomadasys peroteti	42.37	327	1.86	
Pomadasys rogeri	38.03	37	1.67	
Brachydeuterus auritus	32.59	724	1.43	
Pomadasys incisus	27.17	182	1.19	
Sardinella maderensis	19.20	290	0.84	
Lagocephalus laevigatus	17.03	37	0.75	
Lithognathus mormyrus	15.58	37	0.69	
Selene dorsalis	13.41	1196	0.59	
Eucinostomus melanopterus	8.32	72	0.37	
Pseudotolithus brachygnathus	6.52	37	0.29	
Diplodus bellottii	4.72	37	0.21	
Caranx crysos	3.62	37	0.16	
Umbrina canariensis	2.54	37	0.11	
Fistularia tabacaria	2.30	2	0.10	
Penaeus notialis	1.10	37	0.05	
Sphyraena sphyraena	0.72	37	0.03	
Pseudupeneus prayensis	0.37	37	0.02	
Total	2274.43		99.99	

DR. FRIDTJOF NANSEN PROJECT:W3 PROJECT STATION:2251
DATE: 5/11/04 GEAR TYPE: BT No: 8 POSITION:Lat N 1652
start stop duration Long W 1639
TIME :11:17:10 11:47:01 30 (min) Purpose code: 1
LOG :8201.17 8202.98 1.78 Area code : 3
FDEPTH: 89 80 GearCond.code:
BDEPTH: 89 80 Validity code:
Towing dir: 90ø Wire out: 280 m Speed: 36 kn*10

Sorted: 35 Kg Total catch: 35.48 CATCH/HOUR: 70.96

SPECIES	CATCH/HOUR weight	numbers	% OF TOT. C	SAMP
Trachurus trecae	26.30	1340	37.06	3743
Loligo vulgaris	12.62	96	17.78	
Decapterus rhonchus	11.80	18	16.63	3744
Zeus faber	4.98	12	7.02	
GALATHEIDAE	4.88	1538	6.88	
Trichiurus lepturus	3.86	6	5.44	
Arius parkii	2.84	10	4.00	
Illex coindetii	1.20	12	1.69	
Merluccius senegalensis	0.88	2	1.24	
Todaropsis eblanae	0.54	108	0.76	
Dentex angolensis	0.50	10	0.70	
Pagellus bellottii	0.26	24	0.37	
Boops boops	0.18	12	0.25	
Portunus validus	0.08	20	0.11	
Blennius normani	0.08	2	0.11	
Sphyraena guachancho	0.04	2	0.06	
Total	71.04		100.10	

DR. FRIDTJOF NANSEN PROJECT:W3 PROJECT STATION:2252
DATE: 5/11/04 GEAR TYPE: PT No: 2 POSITION:Lat N 1702
start stop duration Long W 1633
TIME :18:10:35 18:39:58 29 (min) Purpose code: 1
LOG :8246.57 8248.60 2.00 Area code : 3
FDEPTH: 25 30 GearCond.code:
BDEPTH: 80 86 Validity code:
Towing dir: 270ø Wire out: 155 m Speed:410 kn*10

Sorted: Kg Total catch: 26.88 CATCH/HOUR: 55.61

SPECIES	CATCH/HOUR weight	numbers	% OF TOT. C	SAMP
Decapterus rhonchus	14.86	89	26.72	3746
Sardinella maderensis	14.86	74	26.72	3745
Trichiurus lepturus	11.83	70	21.27	
Chloroscombrus chrysurus	8.92	43	16.04	
Trachinotus ovatus	4.14	12	7.44	
Brachydeuterus auritus	0.66	4	1.19	
Illex coindetii	0.35	6	0.63	
Total	55.62		100.01	

DR. FRIDTJOF NANSEN PROJECT:W3 PROJECT STATION:2253
DATE: 5/11/04 GEAR TYPE: PT No: 1 POSITION:Lat N 1713
start stop duration Long W 1620
TIME :23:00:02 23:31:49 32 (min) Purpose code:
LOG :8281.37 8283.06 1.34 Area code : 3
FDEPTH: 15 22 GearCond.code: 1
BDEPTH: 39 36 Validity code:
Towing dir: 90ø Wire out: 190 m Speed: 37 kn*10

Sorted: 69 Kg Total catch: 880.00 CATCH/HOUR: 1650.00

SPECIES	CATCH/HOUR weight	numbers	% OF TOT. C	SAMP
Brachydeuterus auritus	1256.63	10864	76.16	
Pagellus bellottii	120.38	984	7.30	
Pomadasys incisus	52.13	294	3.16	
Pomadasys peroteti	48.75	131	2.95	
Pagellus acarne	41.25	294	2.50	
Arius parkii	36.38	98	2.20	
Alectis alexandrinus	25.50	28	1.55	
Chelidonichthys gabonensis	22.97	229	1.39	
Decapterus rhonchus	21.94	98	1.33	
Galeoides decadactylus	10.13	98	0.61	
Trichiurus lepturus	5.04	26	0.31	
Loligo vulgaris	2.46	9	0.15	
Sepia officinalis hierredda	2.16	2	0.13	
Fistularia petimba	1.50	6	0.09	
Selene dorsalis	1.31	32	0.08	
Sphyraena guachancho	1.22	2	0.07	
Penaeus notialis	0.32	32	0.02	
Total	1650.07		100.00	

DR. FRIDTJOF NANSEN PROJECT:W3 PROJECT STATION:2254
DATE: 6/11/04 GEAR TYPE: BT No: 8 POSITION:Lat N 1733
start stop duration Long W 1612
TIME :09:26:53 09:56:08 29 (min) Purpose code: 1
LOG :8371.76 8373.67 1.89 Area code : 3
FDEPTH: 37 38 GearCond.code:
BDEPTH: 37 38 Validity code:
Towing dir: 3ø Wire out: 130 m Speed: 32 kn*10

Sorted: 54 Kg Total catch: 172.75 CATCH/HOUR: 357.41

SPECIES	CATCH/HOUR weight	numbers	% OF TOT. C	SAMP
Sparus caeruleostictus *	131.07	319	36.67	
Pagellus bellottii	45.62	232	12.76	
Plectorhinchus mediterraneus	38.23	87	10.70	
Loligo vulgaris	32.59	95	9.12	
Diplodus puntazzo	30.85	29	8.63	
Decapterus rhonchus	26.28	153	7.35	3747
Pomadasys incisus	14.83	87	4.15	
Diplodus sargus *	11.73	14	3.28	
Epinephelus aeneus	11.17	2	3.13	
Pomadasys rogeri	5.30	6	1.48	
J E L L Y F I S H	4.28	23	1.20	
Sphoeroides cutaneus	2.90	6	0.81	
Sphyraena sphyraena	1.45	6	0.41	
Epinephelus goreensis	1.12	2	0.31	
Total	357.42		100.00	

DR. FRIDTJOF NANSEN PROJECT:W3 PROJECT STATION:2255
DATE: 6/11/04 GEAR TYPE: BT No: 8 POSITION:Lat N 1732
start stop duration Long W 1620

TIME :11:25:16 11:58:10 33 (min) Purpose code: 1
LOG :8384.92 8386.83 1.77 Area code : 3
FDEPTH: 72 85 GearCond.code:
BDEPTH: 72 85 Validity code:
Towing dir: 270ø Wire out: 250 m Speed: 32 kn*10

Sorted: 57 Kg Total catch: 1506.25 CATCH/HOUR: 2738.64

SPECIES	CATCH/HOUR weight	numbers	% OF TOT. C	SAMP
J E L L Y F I S H	2127.27	851	77.68	
Trichiurus lepturus	364.00	2175	13.29	
Decapterus rhonchus	224.55	898	8.20	3748
Sardinella maderensis	12.29	47	0.45	
Pagellus bellottii	3.31	331	0.12	
Zeus faber	2.89	5	0.11	
Trachurus trecae	1.89	189	0.07	
Diplodus puntazzo	1.55	2	0.06	
Boops boops	0.47	142	0.02	
Loligo vulgaris	0.42	4	0.02	
Total	2738.64		100.02	

DR. FRIDTJOF NANSEN PROJECT:W3 PROJECT STATION:2256
DATE: 6/11/04 GEAR TYPE: BT No: 8 POSITION:Lat N 1742
start stop duration Long W 1627
TIME :16:28:56 16:49:03 20 (min) Purpose code: 1
LOG :8427.15 8428.12 0.96 Area code : 3
FDEPTH: 119 118 GearCond.code:
BDEPTH: 119 118 Validity code:
Towing dir: 190ø Wire out: 380 m Speed: 30 kn*10

Sorted: Kg Total catch: 143.33 CATCH/HOUR: 429.99

SPECIES	CATCH/HOUR weight	numbers	% OF TOT. C	SAMP
Synagrops microlepis	139.65	14211	32.48	
Trichiurus lepturus	111.30	522	25.88	
Trachurus trecae, juvenile	63.90	2607	14.86	3749
Trachurus trecae	42.00	534	9.77	3750
Portunus validus	19.08	2328	4.44	
Decapterus rhonchus	18.12	87	4.21	3751
Merluccius senegalensis	14.43	96	3.36	
Zeus faber	6.60	39	1.53	
Octopus vulgaris	4.29	9	1.00	
Pteroscion peli	3.84	57	0.89	
Gobius sp	1.32	165	0.31	
Trachurus trachurus	1.23	48	0.29	
GALATHEIDAE *	0.96	360	0.22	
Boops boops	0.81	72	0.19	
Dentex macrophthalmus	0.63	3	0.15	
Helicolenus dactylopterus	0.54	105	0.13	
Illex coindetii	0.48	12	0.11	
Zenopsis conchifer	0.39	6	0.09	
Grammoplites gruveli	0.15	3	0.03	
Chlorophthalmus atlanticus	0.15	6	0.03	
Blennius sp.	0.09	3	0.02	
Capros aper	0.03	6	0.01	
Total	429.99		100.00	

DR. FRIDTJOF NANSEN PROJECT:W3 PROJECT STATION:2257
DATE: 6/11/04 GEAR TYPE: BT No: 8 POSITION:Lat N 1753
start stop duration Long W 1610
TIME :20:56:45 21:11:27 15 (min) Purpose code: 1
LOG :8464.41 8465.34 0.93 Area code : 3
FDEPTH: 24 19 GearCond.code:
BDEPTH: 24 19 Validity code:
Towing dir: 90ø Wire out: 105 m Speed: 37 kn*10

Sorted: 56 Kg Total catch: 461.52 CATCH/HOUR: 1846.08

SPECIES	CATCH/HOUR weight	numbers	% OF TOT. C	SAMP
Galeoides decadactylus	622.40	5056	33.71	
Pomadasys incisus	254.40	2208	13.78	
Pseudupeneus prayensis	208.64	672	11.30	
Pomadasys jubelini	125.12	320	6.78	
Sparus caeruleostictus *	94.40	288	5.11	
Pomadasys peroteti	89.60	128	4.85	
Brachydeuterus auritus	88.64	896	4.80	
Pagellus bellottii	81.92	736	4.44	
Leptocharias smithii	56.00	96	3.03	
Dentex canariensis	44.48	448	2.41	
Decapterus rhonchus	44.16	416	2.39	
Boops boops	40.64	352	2.20	
Diplodus bellottii	40.32	1056	2.18	
Arius parkii	28.80	224	1.56	
Rhinobatos rhinobatos	10.56	8	0.57	
Pisodonophis semicinctus	4.48	16	0.24	
Penaeus kerathurus	3.20	192	0.17	
Liocarcinus corrugatus	2.56	224	0.14	
Penaeus notialis	2.24	64	0.12	
Selene dorsalis	2.24	128	0.12	
Sphoeroides spengleri	0.64	32	0.03	
Syacium micrurum	0.64	32	0.03	
Total	1846.08		99.96	

DR. FRIDTJOF NANSEN PROJECT:W3 PROJECT STATION:2258
DATE: 7/11/04 GEAR TYPE: PT No: 2 POSITION:Lat N 1802
start stop duration Long W 1620
TIME :05:01:07 05:01:13 22 (min) Purpose code: 1
LOG :8533.59 8535.02 1.41 Area code : 3
FDEPTH: 20 18 GearCond.code:
BDEPTH: 78 84 Validity code:
Towing dir: 270ø Wire out: 110 m Speed: 38 kn*10

Sorted: 59 Kg Total catch: 59.11 CATCH/HOUR: 161.21

SPECIES	CATCH/HOUR weight	numbers	% OF TOT. C	SAMP
Trichiurus lepturus	83.32	461	51.68	
J E L L Y F I S H	51.41	25	31.89	
Sardinella maderensis	17.73	93	11.00	3753
Trachurus trecae, juvenile	4.96	251	3.08	3752
Mugil capurrii	2.54	3	1.58	
Sardinella aurita	1.23	5	0.76	
Boops boops	0.03	3	0.02	
Total	161.22		100.01	

DR. FRIDTJOF NANSEN PROJECT:W3 PROJECT STATION:2259
DATE: 7/11/04 GEAR TYPE: PT No: 7 POSITION:Lat N 1806
start stop duration Long W 1609
TIME :08:58:38 09:29:24 31 (min) Purpose code: 1
LOG :8560.27 8562.31 1.72 Area code : 3
FDEPTH: 10 10 GearCond.code:
BDEPTH: 19 19 Validity code:
Towing dir: 150ø Wire out: 230 m Speed: 42 kn*10

Sorted: Kg Total catch: 105.85 CATCH/HOUR: 204.87

SPECIES	CATCH/HOUR weight	numbers	% OF TOT. C	SAMP
Chloroscombrus chrysurus	79.94	621	39.02	
J E L L Y F I S H	64.26	21	31.37	
Pomadasys incisus	18.19	166	8.88	
Sardinella maderensis	7.92	48	3.87	3754
Decapterus rhonchus	6.19	29	3.02	3755
Arius parkii	4.63	35	2.26	
Sphyrna lewini	4.41	2	2.15	
Balistes capriscus	3.48	2	1.70	
Trichiurus lepturus	3.10	6	1.51	
Sparus caeruleostictus *	3.10	10	1.51	
Rhizoprionodon acutus	2.71	4	1.32	
Alectis alexandrinus	2.54	41	1.24	
Selene dorsalis	1.59	10	0.78	
Sardinella aurita	0.99	4	0.48	
Campogramma glaycos	0.72	2	0.35	
Trachurus trecae	0.54	4	0.26	
Plectorhinchus mediterraneus	0.50	2	0.24	
Caranx crysos	0.08	10	0.04	
Total	204.89		100.00	

DR. FRIDTJOF NANSEN PROJECT:W3 PROJECT STATION:2260
DATE: 7/11/04 GEAR TYPE: PT No: 1 POSITION:Lat N 1823
start stop duration Long W 1617
TIME :18:30:56 19:03:01 32 (min) Purpose code: 1
LOG :8641.07 8643.04 1.71 Area code : 3
FDEPTH: 10 10 GearCond.code:
BDEPTH: 34 39 Validity code:
Towing dir: 270ø Wire out: 200 m Speed: 40 kn*10

Sorted: 68 Kg Total catch: 243.53 CATCH/HOUR: 456.62

SPECIES	CATCH/HOUR weight	numbers	% OF TOT. C	SAMP
Sardinella aurita	222.15	1050	48.65	3756
Sardinella maderensis	82.03	381	17.96	3757
Decapterus rhonchus	45.73	334	10.01	3758
UNIDENTIFIED FISH	35.36	2612	7.74	
J E L L Y F I S H	32.16	13	7.04	
Brachydeuterus auritus	13.59	92	2.98	
Chloroscombrus chrysurus	6.04	39	1.32	
Pagellus bellottii	5.25	39	1.15	
Loligo vulgaris	3.90	6	0.85	
Scomber japonicus	3.41	6	0.75	
Alectis alexandrinus	3.00	2	0.66	
Euthynnus alletteratus	2.76	6	0.60	
Pomadasys incisus	1.24	6	0.27	
Total	456.62		99.98	

DR. FRIDTJOF NANSEN PROJECT:W3 PROJECT STATION:2261
DATE: 7/11/04 GEAR TYPE: PT No: 2 POSITION:Lat N 1833
start stop duration Long W 1629
TIME :22:45:32 23:16:55 31 (min) Purpose code: 1
LOG :8675.53 8677.52 1.75 Area code : 3
FDEPTH: 5 5 GearCond.code:
BDEPTH: 81 111 Validity code:
Towing dir: 280ø Wire out: 210 m Speed: 40 kn*10

Sorted: 60 Kg Total catch: 333.22 CATCH/HOUR: 644.94

SPECIES	CATCH/HOUR weight	numbers	% OF TOT. C	SAMP
Trichiurus lepturus	294.87	1384	45.72	
Campogramma glaycos	160.95	478	24.96	
MYCTOPHIDAE	132.21	859384	20.50	
J E L L Y F I S H	50.88	43	7.89	
Synagrops microlepis	2.98	414	0.46	
Mugil cephalus	2.52	2	0.39	
Sepia officinalis hierredda	0.52	43	0.08	
Total	644.93		100.00	

DR. FRIDTJOF NANSEN PROJECT:W3 PROJECT STATION:2262
DATE: 8/11/04 GEAR TYPE: PT No: 2 POSITION:Lat N 1843
start stop duration Long W 1623
TIME :05:10:56 05:28:31 18 (min) Purpose code: 1
LOG :8727.96 8729.08 1.11 Area code : 3
FDEPTH: 17 17 GearCond.code:
BDEPTH: 42 54 Validity code:
Towing dir: 270ø Wire out: 100 m Speed: 38 kn*10

Sorted: 41 Kg Total catch: 208.70 CATCH/HOUR: 695.67

SPECIES	CATCH/HOUR weight	numbers	% OF TOT. C	SAMP
J E L L Y F I S H	643.33	717	92.48	
Trachinotus ovatus	20.00	83	2.87	
Trachurus trecae	15.83	450	2.28	
Trichiurus lepturus	14.50	50	2.08	
Bothus podas africanus	1.67	217	0.24	
Sepia elegans	0.33	17	0.05	
Total	695.66		100.00	

DR. FRIDTJOF NANSEN PROJECT:W3 PROJECT STATION:2263
DATE: 8/11/04 GEAR TYPE: PT No: 1 POSITION:Lat N 1852
start stop duration Long W 1629
TIME :09:16:27 09:55:03 39 (min) Purpose code: 1
LOG :8760.38 8762.85 2.37 Area code : 3
FDEPTH: 25 30 GearCond.code:
BDEPTH: 54 63 Validity code:
Towing dir: 170ø Wire out: 95 m Speed: 40 kn*10

Sorted: Kg Total catch: 0.97 CATCH/HOUR: 1.49

SPECIES	CATCH/HOUR weight	numbers	% OF TOT. C	SAMP
Sardinella maderensis	1.05	3	70.47	
Decapterus rhonchus	0.45	2	30.20	
Total	1.50		100.67	

DR. FRIDTJOF NANSEN PROJECT:W3 PROJECT STATION:2264
DATE: 8/11/04 GEAR TYPE: PT No: 2 POSITION:Lat N 1853
start stop duration Long W 1629
TIME :11:12:44 11:57:06 44 (min) Purpose code:
LOG :8772.27 8775.38 2.60 Area code : 3
FDEPTH: 25 20 GearCond.code: 1
BDEPTH: 56 49 Validity code:
Towing dir: 100ø Wire out: 105 m Speed: 42 kn*10

Sorted: 35 Kg Total catch: 35.73 CATCH/HOUR: 48.72

SPECIES	CATCH/HOUR weight	numbers	% OF TOT. C	SAMP
Sardinella maderensis	26.59	87	54.58	3760
Decapterus rhonchus	19.84	80	40.72	3759
Campogramma glaycos	2.29	4	4.70	
Total	48.72		100.00	

DR. FRIDTJOF NANSEN PROJECT:W3 PROJECT STATION:2265
DATE: 8/11/04 GEAR TYPE: BT No: 8 POSITION:Lat N 1853
start stop duration Long W 1645
TIME :14:42:24 15:12:31 30 (min) Purpose code: 1
LOG :8797.40 8798.90 1.48 Area code : 3
FDEPTH: 223 222 GearCond.code:
BDEPTH: 223 222 Validity code:
Towing dir: 340ø Wire out: 650 m Speed: 30 kn*10

Sorted: 58 Kg Total catch: 1307.25 CATCH/HOUR: 2614.50

SPECIES	CATCH/HOUR weight	CATCH/HOUR numbers	% OF TOT. C	SAMP
Helicolenus dactylopterus	1718.20	25564	65.72	
Merluccius polli	299.64		11.46	
Chlorophthalmus atlanticus	256.96	15092	9.83	
Trichiurus lepturus	85.80	132	3.28	
Pontinus accraensis	57.64	484	2.20	
Pteroscion peli	46.64	264	1.78	
Merluccius senegalensis	30.80	44	1.18	
Parapenaeus longirostris	24.20	4224	0.93	
Trachurus trecae	23.40	86	0.90	3761
Synagrops microlepis	21.56	1804	0.82	
Raja straeleni	17.10	12	0.65	
Malacocephalus occidentalis	15.40	440	0.59	
Trachurus trachurus	11.82	24	0.45	3762
Mystriophis rostellatus	2.70	4	0.10	
Gephyroberyx darwini	2.20	44	0.08	
Capros aper	0.44	44	0.02	
Total	2614.50		99.99	

DR. FRIDTJOF NANSEN PROJECT:W3 PROJECT STATION:2267
DATE: 9/11/04 GEAR TYPE: PT No: 2 POSITION:Lat N 1905
start stop duration Long W 1633
TIME :01:36:02 02:00:14 24 (min) Purpose code:
LOG :8873.40 8874.92 1.49 Area code : 3
FDEPTH: 25 25 GearCond.code: 1
BDEPTH: 56 53 Validity code:
Towing dir: 140ø Wire out: 110 m Speed: 37 kn*10

Sorted: 74 Kg Total catch: 73.85 CATCH/HOUR: 184.63

SPECIES	CATCH/HOUR weight	CATCH/HOUR numbers	% OF TOT. C	SAMP
Sardinella maderensis	74.75	240	40.49	3766
Trichiurus lepturus	30.85	128	16.71	
Auxis thazard	28.05	85	15.19	
Campogramma glaycos	23.50	40	12.73	
Trachurus trecae, juvenile	7.28	393	3.94	3767
Trachurus trecae	4.68	25	2.53	
Decapterus rhonchus	4.30	15	2.33	
Sepia bertheloti	3.60	10	1.95	
Mugil cephalus	2.88	3	1.56	
Sardinella aurita	2.35	5	1.27	
Alloteuthis africana	1.00	383	0.54	
Engraulis encrasicolus	0.68	50	0.37	
Boops boops	0.35	20	0.19	
OCTOPOTEUTHIDAE	0.15	3	0.08	
Sepia orbignyana	0.15	8	0.08	
Saurida brasiliensis	0.08	43	0.04	
Total	184.65		100.00	

DR. FRIDTJOF NANSEN PROJECT:W3 PROJECT STATION:2266
DATE: 8/11/04 GEAR TYPE: PT No: 1 POSITION:Lat N 1903
start stop duration Long W 1628
TIME :22:21:10 22:51:32 30 (min) Purpose code: 1
LOG :8852.74 8854.75 1.95 Area code : 3
FDEPTH: 10 10 GearCond.code:
BDEPTH: 33 39 Validity code:
Towing dir: 270ø Wire out: 210 m Speed: 40 kn*10

Sorted: 55 Kg Total catch: 946.67 CATCH/HOUR: 1893.34

SPECIES	CATCH/HOUR weight	CATCH/HOUR numbers	% OF TOT. C	SAMP
Sardina pilchardus	1664.30	9758	87.90	3763
Decapterus rhonchus	99.96	476	5.28	3765
Decapterus rhonchus juv	87.72	3060	4.63	3764
Pagellus bellottii	13.60	136	0.72	
Diplodus puntazzo	10.02	10	0.53	
Pomadasys incisus	5.44	34	0.29	
Sepia officinalis hierredda	5.10	4	0.27	
Trichiurus lepturus	2.54	6	0.13	
Loligo vulgaris	2.02	6	0.11	
Penaeus notialis	1.70	34	0.09	
Sardinella maderensis	0.60	2	0.03	
Boops boops	0.34	34	0.02	
Total	1893.34		100.00	

DR. FRIDTJOF NANSEN PROJECT:W3 PROJECT STATION:2268
DATE: 9/11/04 GEAR TYPE: BT No: 8 POSITION:Lat N 1913
start stop duration Long W 1638
TIME :04:00:20 04:13:13 13 (min) Purpose code: 1
LOG :8891.19 8891.85 0.64 Area code : 3
FDEPTH: 67 63 GearCond.code:
BDEPTH: 67 63 Validity code:
Towing dir: 90ø Wire out: 200 m Speed: 31 kn*10

Sorted: 56 Kg Total catch: 144.09 CATCH/HOUR: 665.03

SPECIES	CATCH/HOUR weight	CATCH/HOUR numbers	% OF TOT. C	SAMP
Pagellus bellottii	391.15	2063	58.82	
J E L L Y F I S H	130.15	102	19.57	
Trichiurus lepturus	73.85	992	11.10	
GOBIIDAE	15.32	6794	2.30	
Pteroscion peli	14.31	600	2.15	
Brachydeuterus auritus	10.85	1292	1.63	
OPHICHTHIDAE	9.92	5	1.49	
Penaeus notialis	7.15	563	1.08	
Arnoglossus imperialis	3.46	286	0.52	
Sepia bertheloti	2.63	92	0.40	
Diplodus vulgaris	2.08	5	0.31	
Umbrina canariensis	1.15	5	0.17	
Syacium micrurum	0.78	9	0.12	
Chelidonichthys gabonensis	0.69	5	0.10	
Penaeus kerathurus	0.55	23	0.08	
Boops boops	0.55	23	0.08	
Sphoeroides spengleri	0.42	5	0.06	
Total	665.01		99.98	

DR. FRIDTJOF NANSEN PROJECT:W3 PROJECT STATION:2269
DATE: 9/11/04 GEAR TYPE: BT No: 8 POSITION:Lat N 1923
start stop duration Long W 1654
TIME :09:13:25 09:44:19 31 (min) Purpose code: 1
LOG :8933.38 8935.10 0.86 Area code : 3
FDEPTH: 103 93 GearCond.code:
BDEPTH: 103 93 Validity code:
Towing dir: 170ø Wire out: 350 m Speed: 37 kn*10

Sorted: 85 Kg Total catch: 1532.91 CATCH/HOUR: 2966.92

SPECIES	CATCH/HOUR weight	CATCH/HOUR numbers	% OF TOT. C	SAMP
Trachurus trachurus	1737.35	7250	58.56	3768
Dentex congoensis	459.99	1777	15.50	
Umbrina canariensis	226.74	546	7.64	
Dentex macrophthalmus	129.95	484	4.38	
Spicara alta	90.62	546	3.05	
Scorpaena scrofa	73.86	135	2.49	
Zeus faber	68.73	68	2.32	
Trachurus trecae	61.90	238	2.09	
Trichiurus lepturus	45.14	135	1.52	
Hyperoglyphe moselii	43.94	8	1.48	
Lagocephalus laevigatus	25.65	33	0.86	
Pagellus bellottii	3.08	33	0.10	
Total	2966.95		99.99	

DR. FRIDTJOF NANSEN PROJECT:W3 PROJECT STATION:2270
DATE: 9/11/04 GEAR TYPE: BT No:15 POSITION:Lat N 1943
start stop duration Long W 1658
TIME :17:28:25 17:46:44 18 (min) Purpose code: 1
LOG :8996.76 8997.73 0.95 Area code : 3
FDEPTH: 49 50 GearCond.code:
BDEPTH: 49 50 Validity code:
Towing dir: 145ø Wire out: 180 m Speed: 31 kn*10

Sorted: 52 Kg Total catch: 1054.26 CATCH/HOUR: 3514.20

SPECIES	CATCH/HOUR weight	CATCH/HOUR numbers	% OF TOT. C	SAMP
Boops boops	2112.50	36660	60.11	
Trichiurus lepturus	678.60	33540	19.31	
Trachurus trecae	330.20	18387	9.40	3769
Sardinella maderensis	97.50	780	2.77	
Chloroscombrus chrysurus	72.80	650	2.07	
Leptocharias smithii	58.33	27	1.66	
Penaeus notialis	45.50	2210	1.29	
Dicologoglossa cuneata	24.70	780	0.70	
Citharus linguatula	22.10	650	0.63	
GOBIIDAE	11.70	1430	0.33	
Sepia bertheloti	10.40	260	0.30	
Sphoeroides spengleri	10.40	130	0.30	
Decapterus rhonchus	8.10	17	0.23	
Pseudotolithus senegalensis	7.80	130	0.22	
Squilla mantis	6.50	130	0.18	
Syacium micrurum	5.20	130	0.15	
Cymbium pepo	5.03	3	0.14	
Umbrina canariensis	2.60	260	0.07	
C R A B S	1.93	63	0.05	
Torpedo torpedo	1.47	3	0.04	
Mystriophis rostellatus	0.83	3	0.02	
Total	3514.19		99.97	

DR. FRIDTJOF NANSEN PROJECT:W3 PROJECT STATION:2271
DATE: 9/11/04 GEAR TYPE: PT No: 2 POSITION:Lat N 1941
start stop duration Long W 1657
TIME :18:50:05 19:27:39 38 (min) Purpose code: 1
LOG :9001.31 9003.64 2.16 Area code : 3
FDEPTH: 10 10 GearCond.code:
BDEPTH: 54 53 Validity code:
Towing dir: 330ø Wire out: 205 m Speed: 38 kn*10

Sorted: 44 Kg Total catch: 872.42 CATCH/HOUR: 1377.50

SPECIES	CATCH/HOUR weight	CATCH/HOUR numbers	% OF TOT. C	SAMP
Chloroscombrus chrysurus	1026.00	8790	74.48	
Trichiurus lepturus	222.00	1290	16.12	
Decapterus rhonchus	38.10	210	2.77	
Trachurus trecae, juvenile	25.20	1260	1.83	3770
Sardinella maderensis	23.70	120	1.72	
PARALEPIDIDAE	23.53	13	1.71	
Penaeus notialis	10.50	480	0.76	
Euthynnus alletteratus	3.41	3	0.25	
Lagocephalus laevigatus	2.94	2	0.21	
Leptocharias smithii	2.13	2	0.15	
Total	1377.51		100.00	

DR. FRIDTJOF NANSEN PROJECT:W3 PROJECT STATION:2272
DATE: 9/11/04 GEAR TYPE: BT No:15 POSITION:Lat N 1953
start stop duration Long W 1711
TIME :22:31:53 23:02:40 31 (min) Purpose code: 1
LOG :9028.10 9029.99 1.86 Area code : 3
FDEPTH: 27 25 GearCond.code:
BDEPTH: 27 25 Validity code:
Towing dir: 90ø Wire out: 120 m Speed: 37 kn*10

Sorted: 57 Kg Total catch: 519.18 CATCH/HOUR: 1004.86

SPECIES	CATCH/HOUR weight	CATCH/HOUR numbers	% OF TOT. C	SAMP
Arius parkii	694.16	2055	69.08	
Pomadasys incisus	90.75	749	9.03	
Engraulis encrasicolus	40.94	6445	4.07	3771
Galeoides decadactylus	33.27	557	3.31	
Raja undulata/picta	31.01	17	3.09	
Pagellus bellottii	23.86	366	2.37	
Rhizoprionodon acutus	19.16	17	1.91	
Pomadasys rogeri	13.06	17	1.30	
Dasyatis marmorata	12.54	17	1.25	
Decapterus rhonchus	9.58	52	0.95	
Argyrosomus regius	6.27	17	0.62	
Dicologoglossa cuneata	4.88	87	0.49	
Sepia officinalis hierredda	4.18	17	0.42	
Squilla mantis	3.31	87	0.33	
Halobatrachus didactylus	3.14	17	0.31	
Halobatrachus didactylus	3.14	17	0.31	
Octopus vulgaris	2.73	2	0.27	
Cymbium sp.	2.09	17	0.21	
Sepia bertheloti	1.74	35	0.17	
Sphoeroides spengleri	1.57	35	0.16	
C R A B S	0.70	35	0.07	
Penaeus kerathurus	0.70	52	0.07	
Microchirus boscanion	0.35	35	0.03	
Sardinella aurita	0.35	52	0.03	
Total	1003.48		99.85	

DR. FRIDTJOF NANSEN PROJECT:W3 PROJECT STATION:2273
DATE:10/11/04 GEAR TYPE: PT No: 7 POSITION:Lat N 2006
start stop duration Long W 1709
TIME :08:21:22 08:51:54 31 (min) Purpose code: 1
LOG :9107.86 9109.73 1.75 Area code : 3
FDEPTH: 10 10 GearCond.code:
BDEPTH: 22 23 Validity code:
Towing dir: 165ø Wire out: 230 m Speed: 39 kn*10

Sorted: 55 Kg Total catch: 555.70 CATCH/HOUR: 1075.55

SPECIES	CATCH/HOUR weight	numbers	% OF TOT. C	SAMP
Chloroscombrus chrysurus	732.19	7568	68.08	
Sardinella maderensis	174.39	1587	16.21	3772
Sphyraena sphyraena	82.84	387	7.70	
Stromateus fiatola	51.48	97	4.79	
Arius parkii	5.81	19	0.54	
Sepia officinalis hierredda	5.42	19	0.50	
Decapterus rhonchus	4.84	19	0.45	
Selene dorsalis	4.84	6	0.45	
Spondyliosoma cantharus	4.65	19	0.43	
Pomatomus saltatrix	3.68	4	0.34	
Brachydeuterus auritus	2.13	19	0.20	
Rhizoprionodon acutus	1.84	2	0.17	
Leptocharias smithii	1.45	2	0.13	
Total	1075.56		99.99	

DR. FRIDTJOF NANSEN PROJECT:W3 PROJECT STATION:2274
DATE:10/11/04 GEAR TYPE: BT No:15 POSITION:Lat N 2011
start stop duration Long W 1736
TIME :13:49:52 14:19:37 30 (min) Purpose code: 1
LOG :9154.31 9155.82 1.50 Area code : 3
FDEPTH: 104 94 GearCond.code:
BDEPTH: 104 94 Validity code:
Towing dir: 10ø Wire out: 320 m Speed: 30 kn*10

Sorted: 30 Kg Total catch: 510.09 CATCH/HOUR: 1020.18

SPECIES	CATCH/HOUR weight	numbers	% OF TOT. C	SAMP
Pteroscion peli	323.00	9894	31.66	
Trichiurus lepturus	247.80	1156	24.29	
GALATHEIDAE *	138.00	47532	13.53	
Synagrops microlepis	137.00	13702	13.43	
Trachurus trecae	40.90	78	4.01	3773
Chloroscombrus chrysurus	19.72	204	1.93	
Octopus vulgaris	16.40	34	1.61	
Solenocera africana	14.28	1700	1.40	
Merluccius polli	13.26	272	1.30	
Scorpaena scrofa	9.18	68	0.90	
Liocarcinus corrugatus	8.84	1020	0.87	
Serranus africana	6.46	68	0.63	
Brotula barbata	5.48	20	0.54	
Zeus faber	5.44	34	0.53	
Helicolenus dactylopterus	5.10	680	0.50	
GOBIIDAE	4.76	442	0.47	
Branchiostegus semifasciatus	4.50	10	0.44	
Capros aper	4.42	1122	0.43	
Parapenaeus longirostris	3.74	816	0.37	
Pontinus accraensis	3.06	102	0.30	
Zenopsis conchifer	2.04	34	0.20	
Symphurus normani	2.04	272	0.20	
Sepia bertheloti	1.36	374	0.13	
Chlorophthalmus atlanticus	1.02	68	0.10	
Arnoglossus imperialis	1.02	68	0.10	
'Spider crab'	0.68	578	0.07	
Laemonema laureysi	0.68	34	0.07	
Total	1020.18		100.01	

DR. FRIDTJOF NANSEN PROJECT:W3 PROJECT STATION:2275
DATE:10/11/04 GEAR TYPE: PT No: 7 POSITION:Lat N 2024
start stop duration Long W 1711
TIME :20:48:04 20:54:43 7 (min) Purpose code: 1
LOG :9209.47 9209.92 0.43 Area code : 3
FDEPTH: 10 10 GearCond.code:
BDEPTH: 29 27 Validity code:
Towing dir: 30ø Wire out: 240 m Speed: 44 kn*10

Sorted: 40 Kg Total catch: 606.99 CATCH/HOUR: 5202.77

SPECIES	CATCH/HOUR weight	numbers	% OF TOT. C	SAMP
J E L L Y F I S H	2404.29	17777	46.21	
Sardinella aurita - Juveniles	1375.54	211286	26.44	3775
Sardinella maderensis	642.60	5100	12.35	3774
Stromateus fiatola	375.94	437	7.23	
Decapterus rhonchus juv	154.46	6703	2.97	3777
Engraulis encrasicolus	80.14	7577	1.54	3776
Campogramma glaycos	49.54	146	0.95	
Sardinella aurita	45.94	266	0.88	
Sardina pilchardus	37.89	1311	0.73	
Diplodus bellottii	17.49	146	0.34	
Loligo vulgaris	11.66	291	0.22	
Trachurus trecae, juvenile	7.29	2331	0.14	
Total	5202.78		100.00	

DR. FRIDTJOF NANSEN PROJECT:W3 PROJECT STATION:2276
DATE:10/11/04 GEAR TYPE: PT No: 7 POSITION:Lat N 2029
start stop duration Long W 1704
TIME :22:38:33 22:53:44 15 (min) Purpose code: 1
LOG :9223.35 9224.34 0.97 Area code : 3
FDEPTH: 10 10 GearCond.code:
BDEPTH: 22 21 Validity code:
Towing dir: 190ø Wire out: 260 m Speed: 40 kn*10

Sorted: 50 Kg Total catch: 1355.94 CATCH/HOUR: 5423.76

SPECIES	CATCH/HOUR weight	numbers	% OF TOT. C	SAMP
Sardinella maderensis	2494.80	6588	46.00	3779
Diplodus bellottii	1420.20	13500	26.18	
Sardinella aurita	927.72	6912	17.10	3778
Stromateus fiatola	225.72	216	4.16	
Arius parkii	118.80	324	2.19	
Pagellus bellottii	85.32	1404	1.57	
Decapterus rhonchus juv	63.72	2484	1.17	3780
Trachurus trecae	29.16	324	0.54	
Pomadasys incisus	27.00	108	0.50	
Decapterus rhonchus	21.60	108	0.40	
Loligo vulgaris	9.72	108	0.18	
Total	5423.76		99.99	

DR. FRIDTJOF NANSEN PROJECT:W3 PROJECT STATION:2277
DATE:11/11/04 GEAR TYPE: PT No: 1 POSITION:Lat N 2033
start stop duration Long W 1714
TIME :01:04:35 01:24:49 20 (min) Purpose code: 1
LOG :9242.83 9244.22 1.40 Area code : 3
FDEPTH: 22 15 GearCond.code:
BDEPTH: 38 39 Validity code:
Towing dir: ø Wire out: 100 m Speed: 40 kn*10

Sorted: 27 Kg Total catch: 137.35 CATCH/HOUR: 412.05

SPECIES	CATCH/HOUR weight	numbers	% OF TOT. C	SAMP
Sardina pilchardus	399.00	2445	96.83	3781
Trachurus trecae	8.85	90	2.15	
Pagellus bellottii	1.95	135	0.47	
Sepia bertheloti	1.20	15	0.29	
Loligo vulgaris	0.45	15	0.11	
Engraulis encrasicolus	0.45	15	0.11	
Selene dorsalis	0.15	15	0.04	
Total	412.05		100.00	

DR. FRIDTJOF NANSEN PROJECT:W3 PROJECT STATION:2278
DATE:11/11/04 GEAR TYPE: PT No: 7 POSITION:Lat N 2033
start stop duration Long W 1721
TIME :02:46:26 02:54:40 8 (min) Purpose code:
LOG :9254.02 9254.43 0.40 Area code : 3
FDEPTH: 10 10 GearCond.code: 1
BDEPTH: 45 44 Validity code:
Towing dir: 90ø Wire out: 180 m Speed: 30 kn*10

Sorted: 55 Kg Total catch: 441.56 CATCH/HOUR: 3311.70

SPECIES	CATCH/HOUR weight	numbers	% OF TOT. C	SAMP
Sardina pilchardus	3112.50	17400	93.98	3782
Sardinella maderensis	142.20	1260	4.29	3783
BELONIDAE	28.20	240	0.85	
Trichiurus lepturus	16.80	60	0.51	
Sardinella aurita	9.00	60	0.27	
Trachurus trecae	3.00	60	0.09	
Total	3311.70		99.99	

DR. FRIDTJOF NANSEN PROJECT:W3 PROJECT STATION:2279
DATE:11/11/04 GEAR TYPE: BT No:15 POSITION:Lat N 2043
start stop duration Long W 1737
TIME :12:02:58 12:24:20 21 (min) Purpose code: 1
LOG :9327.61 9328.70 1.07 Area code : 3
FDEPTH: 98 98 GearCond.code:
BDEPTH: 98 98 Validity code:
Towing dir: 40ø Wire out: 320 m Speed: 30 kn*10

Sorted: 26 Kg Total catch: 118.33 CATCH/HOUR: 338.09

SPECIES	CATCH/HOUR weight	numbers	% OF TOT. C	SAMP
Synagrops microlepis	137.17	10183	40.57	
Liocarcinus corrugatus	62.60	5309	18.52	
GALATHEIDAE *	52.20	10889	15.44	
Solenocera africana	27.37	15569	8.10	
Helicolenus dactylopterus	18.63	2249	5.51	
Chlorophthalmus atlanticus	13.37	1054	3.95	
Capros aper	9.89	1286	2.93	
Lagocephalus laevigatus	5.00	11	1.48	
Pteroscion peli	3.60	129	1.06	
Trichiurus lepturus	2.69	11	0.80	
Merluccius polli	1.91	37	0.56	
Zeus faber	1.54	11	0.46	
Trachurus trachurus	0.77	26	0.23	
Pagellus bellottii	0.63	11	0.19	
Scyllarides herklotsii	0.26	51	0.08	
Sepiella ornata	0.11	11	0.03	
Illex coindetii	0.11	37	0.03	
Todarodes sagittatus	0.11	26	0.03	
Symphurus normani	0.11	37	0.03	
Total	338.07		100.00	

DR. FRIDTJOF NANSEN PROJECT:W3 PROJECT STATION:2280
DATE:11/11/04 GEAR TYPE: PT No: 1 POSITION:Lat N 2043
start stop duration Long W 1720
TIME :15:00:33 15:00:50 14 (min) Purpose code: 1
LOG :9349.07 9349.97 0.88 Area code : 3
FDEPTH: 10 10 GearCond.code: 1
BDEPTH: 44 55 Validity code:
Towing dir: 270ø Wire out: 160 m Speed: 40 kn*10

Sorted: 5 Kg Total catch: 177.30 CATCH/HOUR: 759.86

SPECIES	CATCH/HOUR weight	numbers	% OF TOT. C	SAMP
J E L L Y F I S H	750.00	3677	98.70	
Scomber japonicus	9.86	30	1.30	3784
Total	759.86		100.00	

DR. FRIDTJOF NANSEN PROJECT:W3 PROJECT STATION:2281
DATE:11/11/04 GEAR TYPE: PT No: 2 POSITION:Lat N 2044
start stop duration Long W 1720
TIME :16:29:35 16:47:40 18 (min) Purpose code: 1
LOG :9353.61 9354.63 0.98 Area code : 3
FDEPTH: 10 10 GearCond.code:
BDEPTH: 49 49 Validity code:
Towing dir: ø Wire out: 160 m Speed: 35 kn*10

Sorted: 22 Kg Total catch: 22.35 CATCH/HOUR: 74.50

SPECIES	CATCH/HOUR weight	numbers	% OF TOT. C	SAMP
J E L L Y F I S H	65.67	407	88.15	
Sardinella aurita	5.67	13	7.61	
Sardinella maderensis	3.17	10	4.26	
Total	74.51		100.02	

Annex III Instruments and fishing gear used

The Simrad EK-500, 38kHz scientific echosounder was used for abundance estimation during the survey, in addition data from the 18 kHz, 120 kHz and 200 kHz transducers where recorded for possible future multifrequency target identification. The Bergen Echo Integrator system (BEI) recorded the hydroacoustic data and was used to scrutinize the acoustic records, and to allocate integrator data to fish species. All raw data were stored to tape and brought back to IMR for storing.

The details of the settings of the echosounders were as follows:

Transceiver 1 menu

Transducer depth	5.5 m
Absorption coeff.	10 dB/km
Pulse length	medium (1ms)
Bandwidth	wide
Max power	2000 Watt
2-way beam angle	-21.0 dB
SV transducer gain	27.17dB
TS transducer gain	29.96
Angle sensitivity	21.9
3 dB beamwidth along.	7.3
3 dB beamwidth athw.	7.0
Alongship offset	0.05
Athwardship offset	0.04

Transceiver 2 menu

Transducer depth	5.5 m
Absorption coeff.	38 dB/km
Pulse length	long (1ms)
Bandwidth	narrow
Max power	1000 Watt
2-way beam angle	-20.6 dB
SV transducer gain	25.96B
TS transducer gain	25.95dB
Angle sensitivity	21.0
3 dB beamwidth along.	7.4
3 dB beamwidth athw.	7.2
Alongship offset	0.24
Athwardship offset	0.04

Transceiver 3 menu

Transducer depth	5.5 m
Absorption coeff.	3 dB/km
Pulse length	short (0.7ms)
Bandwidth	wide
Max power	2000 Watt
2-way beam angle	-17.2 dB
SV transducer gain	23.75dB
TS transducer gain	23.36B
Angle sensitivity	13.9
3 dB beamwidth along.	10.8
3 dB beamwidth athw.	10.8
Alongship offset	0.06
Athwardship offset	-004

Transceiver 4 menu

Transducer depth	5.5 m
Absorption coeff.	53 dB/km
Pulse length	Long
Bandwidth	Narrow
Max power	1000 Watt
2-way beam angle	-20.5 dB
SV transducer gain	24.18 dB
TS transducer gain	24.80 dB
Angle sensitivity	0.0
3 dB beamwidth along.	0.0°
3 dB beamwidth athw.	0.0°
Alongship offset -	0.00°
Athwardship offset	0.00°

Display menu

Echogram	1
Bottom range	10 m
Bottom range start	10 m
TVG	20 log R
Sv colour min -	65 dB
TS Colour minimum	-65 dB

Printer- menu

Range	0-50, 0-100, 0-150, 0-250 or 0-500 m
TVG	20 log R
Sv colour min	-67 dB

Bottom detection menu

Minimum level	-40 dB

Calibration

A calibration of the acoustic equipment was conducted during the survey in Angola in August 2004.

Fishing gear

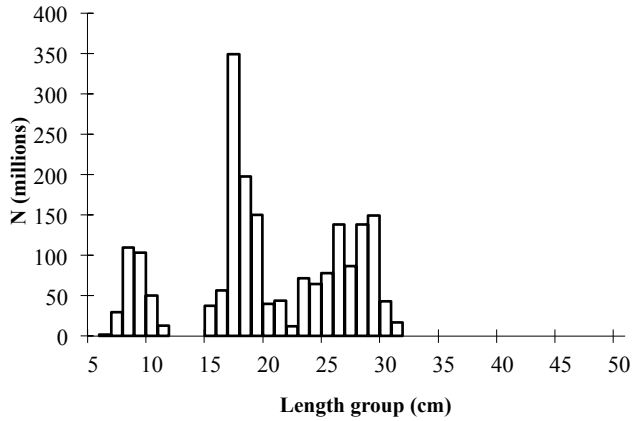
The vessel has three different sized four-panel 'Åkrahamn' pelagic trawls and one ‘Gisund super bottom trawl’. The two smallest pelagic trawls and the demersal trawl were used during the survey. The smallest pelagic trawl has 10-12 m vertical opening under normal operation, whereas the intermediate sized trawl has 15-18 m opening.

The bottom trawl has a 31 m headline and a 47 m footrope fitted with a 12" rubber bobbins gear. The codend has 20 mm meshes, and has an inner net with 10 mm mesh size. The vertical opening is about 5.5 m. The distance between the wing tips is about 18 m during towing. The sweeps are 40 m long. The trawl doors are 'Thyborøen' combi, 8 m^2 and weigh 2000 kg. The door spreading is about 45 m when using restraining rope. Trawling was conducted for species identification only and no restraining rope was therefore used during the survey.

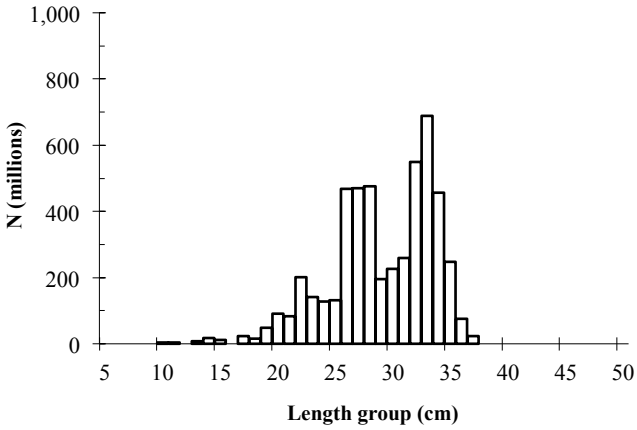
The SCANMAR system was used during all trawl hauls. This equipment consists of sensors, a hydrophone, a receiver, a display unit and a battery charger. Communication between sensors and ship is based on acoustic transmission. The doors are fitted with sensors to provide information on their distance and a height sensor is fitted on the bottom trawl to measure the trawl opening and provide information on clearance and bottom contact.

The pelagic trawls are equipped with a trawl eye that provides information about the trawl opening and the distance of the footrope to the bottom. A pressure sensor is used to show the depth on the headline.

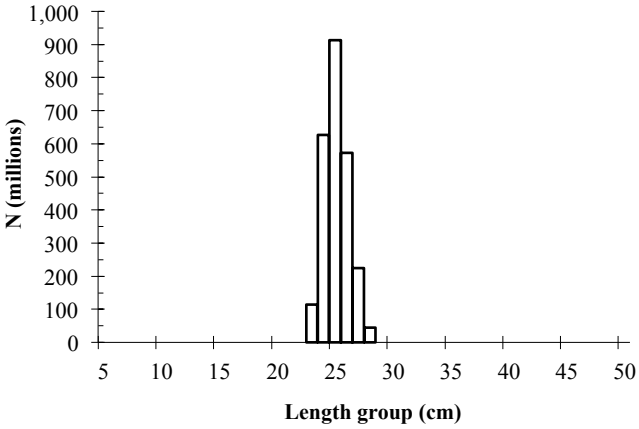
Annex III. Pooled length distribution by species and region



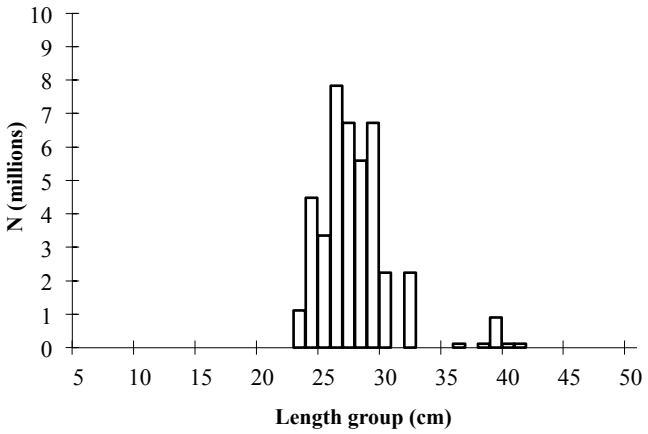
S. aurita (*Sardinella aurita*) November 2004



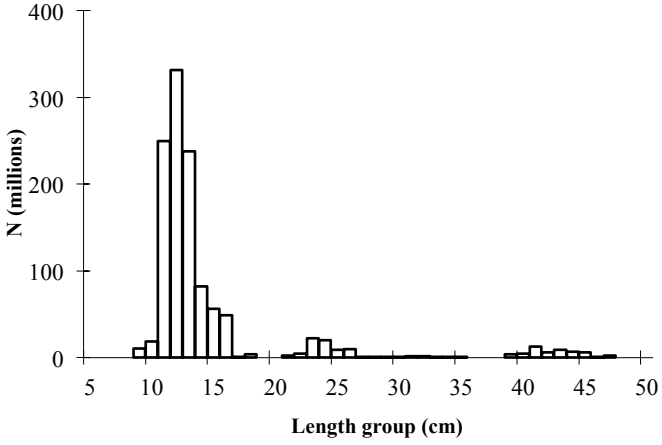
S. maderensis (*Sardinella maderensis*) November 2004



Sardine (*Sardina pilchardus*) November 2004



Atlantic horse mackerel (*Trachurus trachurus*) November 2004



Cunene horse mackerel (*Trachurus trecae*) November 2004

Annex IV. Estimated number and biomass by length-group and sectors

Round sardinella (*Sardinella aurita*) November 2004

Numbers in millions

Length cm	St. Louis - Cape Timiris	Cape Timiris - Cape Blanc	TOTAL
5			
6		2.1	2.1
7		29.5	29.5
8		109.4	109.4
9		103.1	103.1
10		50.5	50.5
11		12.6	12.6
12			
13			
14			
15	37.9		37.9
16	56.8		56.8
17	349.7		349.7
18	198.1		198.1
19	149.9		149.9
20	37.9	2.5	40.4
21	36.3	7.4	43.7
22		12.4	12.4
23		71.9	71.9
24	17.3	47.1	64.4
25	60.6	17.3	78.0
26	138.5		138.5
27	86.6		86.6
28	138.5		138.5
29	147.2	2.5	149.7
30	43.3		43.3
31	17.3		17.3
32			
33			
34			
35			
36			
37			
38			
39			
40			
41			
42			
43			
44			
45			
46			
47			
48			
49			
50			
Total	1 516.0	468.3	1 984.3

Biomass in tons

Length cm	St. Louis - Cape Timiris	Cape Timiris - Cape Blanc	TOTAL
5			
6		6	6
7		119	119
8		645	645
9		849	849
10		561	561
11		184	184
12			
13			
14			
15	1 355		1 355
16	2 451		2 451
17	17 990		17 990
18	12 042		12 042
19	10 673		10 673
20	3 134	205	3 339
21	3 460	709	4 169
22		1 355	1 355
23		8 953	8 953
24	2 445	6 647	9 092
25	9 649	2 761	12 410
26	24 752		24 752
27	17 288		17 288
28	30 790		30 790
29	36 280	611	36 891
30	11 793		11 793
31	5 197		5 197
32			
33			
34			
35			
36			
37			
38			
39			
40			
41			
42			
43			
44			
45			
46			
47			
48			
49			
50			
Total	189 298	23 606	212 904

Flat sardinella (*Sardinella maderensis*) November 2004

Numbers in millions

Length cm	St. Louis - Cape Timiris	Cape Timiris - Cape Blanc	TOTAL
5.0			
6.0			
7.0			
8.0			
9.0			
10.0		3.8	3.8
11.0		3.8	3.8
12.0			
13.0	8.6		8.6
14.0	17.2		17.2
15.0	8.6	2.5	11.1
16.0			
17.0	8.6	15.0	23.6
18.0	8.6	7.6	16.2
19.0		49.0	49.0
20.0		90.6	90.6
21.0		83.6	83.6
22.0	8.6	192.5	201.1
23.0		140.6	140.6
24.0	32.3	96.2	128.5
25.0	86.1	45.1	131.2
26.0	437.2	30.4	467.6
27.0	446.9	22.9	469.8
28.0	475.1		475.1
29.0	189.5	6.4	195.9
30.0	225.5		225.5
31.0	260.2		260.2
32.0	549.6		549.6
33.0	688.4	0.1	688.5
34.0	456.8		456.8
35.0	248.6		248.6
36.0	75.2		75.2
37.0	23.1		23.1
38.0			
39.0			
40.0			
41.0			
42.0			
43.0			
44.0			
45.0			
46.0			
47.0			
48.0			
49.0			
50.0			
Total	4 254.7	790.1	5 044.9

Biomass in tons

Length cm	St. Louis - Cape Timiris	Cape Timiris - Cape Blanc	TOTAL
5			
6			
7			
8			
9			
10		43	43
11		56	56
12			
13	203		203
14	504		504
15	308	90	398
16			
17	443	771	1 214
18	523	459	982
19		3 489	3 489
20		7 491	7 491
21		7 978	7 978
22	942	21 052	21 994
23		17 512	17 512
24	4 554	13 585	18 140
25	13 699	7 186	20 885
26	78 108	5 437	83 545
27	89 227	4 565	93 792
28	105 572		105 572
29	46 707	1 566	48 273
30	61 432		61 432
31	78 071		78 071
32	181 116		181 116
33	248 440	38	248 478
34	180 078		180 078
35	106 790		106 790
36	35 091		35 091
37	11 709		11 709
38			
39			
40			
41			
42			
43			
44			
45			
46			
47			
48			
49			
50			
Total	1243 518	91 319	1334 836

Sardine (*Sardina pilchardus*) November 2004

Numbers in millions

Length cm	St. Louis - Cape Timiris	Cape Timiris - Cape Blanc	TOTAL
5.0			
6.0			
7.0			
8.0			
9.0			
10.0			
11.0			
12.0			
13.0			
14.0			
15.0			
16.0			
17.0			
18.0			
19.0			
20.0			
21.0			
22.0			
23.0	7.5	106.8	114.3
24.0	37.6	588.3	625.9
25.0	40.6	872.5	913.2
26.0	31.6	541.3	572.9
27.0	9.0	214.8	223.9
28.0	1.5	42.3	43.8
29.0			
30.0			
31.0			
32.0			
33.0			
34.0			
35.0			
36.0			
37.0			
38.0			
39.0			
40.0			
41.0			
42.0			
43.0			
44.0			
45.0			
46.0			
47.0			
48.0			
49.0			
50.0			
Total	127.9	2 366.1	2 494.0

Biomass in tons

Length cm	St. Louis - Cape Timiris	Cape Timiris - Cape Blanc	TOTAL
5			
6			
7			
8			
9			
10			
11			
12			
13			
14			
15			
16			
17			
18			
19			
20			
21			
22			
23	937	13 309	14 246
24	5 310	83 060	88 370
25	6 467	138 890	145 357
26	5 645	96 704	102 348
27	1 802	42 894	44 696
28	334	9 390	9 724
29			
30			
31			
32			
33			
34			
35			
36			
37			
38			
39			
40			
41			
42			
43			
44			
45			
46			
47			
48			
49			
50			
Total	20 496	384 246	404 742

Cunene horse mackerel (*Trachurus trecae*) November 2004

Numbers in millions

Length cm	St. Louis - Cape Timiris	Cape Timiris - Cape Blanc	TOTAL
5			
6			
7			
8			
9		10.3	10.3
10	5.9	12.8	18.7
11	35.5	214.2	249.7
12	59.0	272.3	331.3
13	70.2	167.4	237.6
14	58.3	24.1	82.3
15	56.1		56.1
16	39.0	10.3	49.3
17	0.8		0.8
18	3.8		3.8
19			
20			
21	2.5		2.5
22	5.0		5.0
23	22.5		22.5
24	20.0		20.0
25	8.8		8.8
26	10.2		10.2
27	1.3		1.3
28	0.1		0.1
29	0.2		0.2
30	0.9	0.3	1.2
31	0.8	0.7	1.5
32	1.5	0.3	1.8
33	0.6		0.6
34	0.7		0.7
35		1.1	1.1
36			
37			
38			
39	0.6	3.2	3.8
40	0.5	4.3	4.8
41	1.0	11.7	12.8
42	1.5	4.3	5.8
43	1.5	7.5	9.0
44	3.6	3.2	6.8
45	1.5	4.3	5.8
46	0.5		0.5
47		2.1	2.1
48			
49			
50			
Total	414.3	754.3	1 168.6

Biomass in tons

Length cm	St. Louis - Cape Timiris	Cape Timiris - Cape Blanc	TOTAL
5			
6			
7			
8			
9		85	85
10	65	142	207
11	518	3 128	3 646
12	1 106	5 105	6 211
13	1 658	3 954	5 612
14	1 705	705	2 410
15	2 004		2 004
16	1 681	444	2 125
17	41		41
18	233		233
19			
20			
21	238		238
22	546		546
23	2 798		2 798
24	2 818		2 818
25	1 405		1 405
26	1 816		1 816
27	268		268
28	25		25
29	56		56
30	248	90	338
31	239	198	438
32	488	109	597
33	206		206
34	269		269
35		458	458
36			
37			
38			
39	368	1 894	2 262
40	324	2 722	3 046
41	698	8 055	8 752
42	1 124	3 146	4 270
43	1 205	5 903	7 108
44	3 011	2 708	5 719
45	1 379	3 860	5 239
46	491		491
47		2 196	2 196
48			
49			
50			
Total	29 031	44 903	73 934

Atlantic horse mackerel (*Trachurus trachurus*) November 2004

Numbers in millions

Length cm	St. Louis - Cape Timiris	Cape Timiris - Cape Blanc	TOTAL
5			
6			
7			
8			
9			
10			
11			
12			
13			
14			
15			
16			
17			
18			
19			
20			
21			
22			
23		1.1	1.1
24		4.5	4.5
25		3.4	3.4
26		7.8	7.8
27		6.7	6.7
28		5.6	5.6
29		6.7	6.7
30		2.2	2.2
31			
32		2.2	2.2
33			
34			
35			
36	0.1		0.1
37			
38	0.1		0.1
39	0.9		0.9
40	0.1		0.1
41	0.1		0.1
42			
43			
44			
45			
46			
47			
48			
49			
50			
Total	1.4	40.3	41.7

Biomass in tons

Length cm	St. Louis - Cape Timiris	Cape Timiris - Cape Blanc	TOTAL
5			
6			
7			
8			
9			
10			
11			
12			
13			
14			
15			
16			
17			
18			
19			
20			
21			
22			
23		139	139
24		632	632
25		535	535
26		1 400	1 400
27		1 341	1 341
28		1 244	1 244
29		1 655	1 655
30		610	610
31			
32		738	738
33			
34			
35			
36	53		53
37			
38	62		62
39	539		539
40	73		73
41	78		78
42			
43			
44			
45			
46			
47			
48			
49			
50			
Total	805	8 293	9 099

Annex V Regional Estimates, October – December 2004

October-December 2004: Sardine (*Sardina pilchardus*), number in millions

Length cm	C. Cantin-C. Juby	C. Juby-C. Blanc	C. Blanc-C. Timiris	C. Timiris-St. Louis	St. Louis-C. Vert	C. Vert-Casamance	TOTAL
5							
6		295.4					295.4
7		641.5					641.5
8		202.6					202.6
9	21.0	49.0					70.0
10	310.3	188.8					499.2
11	339.0	493.6					832.6
12	365.3	1,524.4					1,889.8
13	758.3	2,834.0					3,592.4
14	2,134.1	3,385.3					5,519.4
15	4,147.9	3,829.7					7,977.6
16	2,436.2	3,150.3					5,586.5
17	1,935.4	1,541.7					3,477.1
18	4,877.2	1,077.5					5,954.6
19	2,513.9	1,854.1					4,368.0
20	499.7	2,171.9					2,671.6
21	90.3	4,547.7					4,638.0
22	20.5	11,849.6					11,870.1
23	20.5	15,503.5	106.8	7.5			15,638.4
24	5.8	11,313.6	588.3	37.6			11,945.4
25		4,533.8	872.5	40.6			5,447.0
26	1.5	1,290.7	541.3	31.6			1,865.1
27		346.3	214.8	9.0			570.1
28		6.3	42.3	1.5			50.0
29							
30							
Total	20,476.8	72,631.4	2,366.1	127.9			95,602.2

October-December 2004: Sardine (*Sardina pilchardus*), biomass in tonnes

Length cm	C. Cantin-C. Juby	C. Juby-C. Blanc	C. Blanc-C. Timiris	C. Timiris-St. Louis	St. Louis-C. Vert	C. Vert-Casamance	TOTAL
5							
6		665					665
7		2,219					2,219
8		1,020					1,020
9	147	345					492
10	2,946	1,793					4,738
11	4,228	6,156					10,384
12	5,851	24,415					30,266
13	15,299	57,177					72,476
14	53,350	84,627					137,977
15	126,660	116,942					243,602
16	89,739	116,042					205,780
17	85,054	67,755					152,809
18	253,219	55,943					309,161
19	152,851	112,732					265,582
20	35,301	153,433					188,734
21	7,355	370,616					377,971
22	1,914	1,106,790					1,108,704
23	2,186	1,649,857	13,309	937			1,666,289
24	701	1,364,314	83,060	5,310			1,453,386
25		616,449	138,890	6,467			761,806
26	222	196,961	96,704	5,645			299,532
27		59,050	42,894	1,802			103,746
28		1,189	9,390	334			10,913
29							
30							
Total	837,021	6,166,489	384,246	20,496			7,408,252

October-December 2004: Round sardinella (*Sardinella aurita*), number in millions

Length cm	C. Cantin-C. Juby	C. Juby-C. Blanc	C. Blanc-C. Timiris	C. Timiris-St. Louis	St. Louis-C. Vert	C. Vert-Casamance	TOTAL
5						0.9	0.9
6			2.1			10.5	12.6
7		10.7	29.5			13.1	53.3
8		138.3	109.4			5.7	253.4
9		162.0	103.1			0.9	266.0
10		108.1	50.5				158.6
11		57.3	12.6		8.5		78.4
12		8.6					8.6
13		7.1			5.0	7.4	19.6
14		3.6			17.0	8.7	29.3
15		3.6		37.9	91.4	11.8	144.7
16				56.8	82.9	27.7	167.5
17		1.4		349.7	151.9	0.6	503.7
18		2.2		198.1	43.8		244.1
19				149.9	71.3		221.2
20		3.7	2.5	37.9	13.6		57.6
21		26.8	7.4	36.3	8.5		79.0
22		40.2	12.4			17.5	70.0
23		18.6	71.9			108.7	199.2
24		27.7	47.1	17.3		187.0	279.1
25		175.8	17.3	60.6		330.4	584.2
26		35.7		138.5		197.2	371.5
27		360.5		86.6		390.8	838.0
28		109.2		138.5		88.9	336.7
29		305.7	2.5	147.2		43.5	498.9
30		476.7		43.3		23.9	543.9
31		399.7		17.3			417.0
32		569.2					569.2
33		320.5					320.5
34		237.0				3.9	240.9
35		227.6					227.6
36		147.2					147.2
37		147.1					147.1
38		42.9					42.9
39		27.2					27.2
40							
41		6.7					6.7
42							
43							
44							
45							
46							
47							
48							
49							
50							
Total		4,208.7	468.3	1,516.0	494.0	1,479.1	8,166.2

October-December 2004: Round sardinella (*Sardinella aurita*), biomass in tonnes

Length cm	C. Cantin-C. Juby	C. Juby-C. Blanc	C. Blanc-C. Timiris	C. Timiris-St. Louis	St. Louis-C. Vert	C. Vert-Casamance	TOTAL
5						1	1
6			6			28	33
7			119			53	172
8		200	645			33	878
9		384	849			7	1,239
10		204	561				765
11		103	184		124		412
12		26					26
13					119	176	295
14					499	254	753
15				1,355	3,269	421	5,045
16				2,451	3,576	1,196	7,222
17		73		17,990	7,817	32	25,911
18		130		12,042	2,663		14,834
19				10,673	5,073		15,746
20		301	205	3,134	1,121		4,761
21		2,503	709	3,460	813		7,485
22		4,303	1,355			1,909	7,567
23		2,270	8,953			13,547	24,770
24		3,830	6,647	2,445		26,393	39,315
25		27,404	2,761	9,649		52,599	92,413
26		6,240		24,752		35,237	66,229
27		70,483		17,288		78,031	165,802
28		22,888		30,790		19,758	73,436
29		71,329	611	36,280		10,722	118,942
30		122,828		11,793		6,511	141,132
31		116,839		5,197			122,036
32		181,711					181,711
33		110,387					110,387
34		88,366				1,529	89,894
35		94,003					94,003
36		66,344					66,344
37		72,927					72,927
38		23,004					23,004
39		15,778					15,778
40							
41		4,532					4,532
42							
43							
44							
45							
46							
47							
48							
49							
50							
Total		1,109,390	23,606	189,298	25,073	248,437	1,595,804

October-December 2004: Flat sardinella (*Sardinella maderensis*), numbers in millions

Length cm	C. Cantin-C. Juby	C. Juby-C. Blanc	C. Blanc-C. Timiris	C. Timiris-St. Louis	St. Louis-C. Vert	C. Vert-Casamance	TOTAL
5							
6							
7							
8					9.7		9.7
9					48.4		48.4
10			3.8		32.3		36.1
11			3.8		19.4		23.2
12							
13				8.6	6.5		15.1
14				17.2	6.5		23.7
15			2.5	8.6			11.1
16					9.7		9.7
17			15.0	8.6			23.6
18			7.6	8.6			16.2
19			49.0			16.2	65.3
20			90.6			52.8	143.3
21			83.6			225.9	309.5
22		6.1	192.5	8.6		507.2	714.4
23		17.9	140.6		9.7	799.1	967.3
24		156.7	96.2	32.3	38.8	840.6	1,164.6
25		355.2	45.1	86.1	53.0	454.4	993.8
26		307.9	30.4	437.2	65.9	270.8	1,112.2
27		513.0	22.9	446.9	35.5	268.4	1,286.7
28		518.7		475.1	13.6	80.0	1,087.4
29		539.1	6.4	189.5		3.7	738.6
30		286.5		225.5		27.6	539.6
31		68.0		260.2			328.2
32		63.5		549.6		16.5	629.6
33		55.6	0.1	688.4			744.1
34		21.4		456.8			478.2
35		24.4		248.6			273.1
36		11.5		75.2			86.7
37				23.1			23.1
38		2.9					2.9
39		2.9					2.9
40							
41							
42							
43							
44							
45							
46							
47							
48							
49							
50							
Total		2,951.4	790.1	4,254.7	348.8	3,563.3	11,908.4

October-December 2004: Flat sardinella (*Sardinella maderensis*), biomass in tonnes

Length cm	C. Cantin-C. Juby	C. Juby-C. Blanc	C. Blanc-C. Timiris	C. Timiris-St. Louis	St. Louis-C. Vert	C. Vert-Casamance	TOTAL
5							
6							
7							
8					57		57
9					399		399
10			43		359		402
11			56		283		339
12							
13				203	153		356
14				504	189		693
15			90	308			398
16					418		418
17			771	443			1,214
18			459	523			982
19			3,489			1,156	4,646
20			7,491			4,365	11,855
21			7,978			21,554	29,532
22		672	21,052	942		55,462	78,127
23		2,258	17,512		1,207	99,557	120,534
24		22,352	13,585	4,554	5,471	118,681	164,645
25		57,126	7,186	13,699	8,431	72,339	158,781
26		55,060	5,437	78,108	11,770	48,377	198,752
27		102,813	4,565	89,227	7,093	53,583	257,280
28		113,111		105,572	3,014	17,781	239,478
29		122,200	1,566	46,707		907	171,380
30		62,398		61,432		7,506	131,337
31		9,181		78,071			87,252
32		12,209		181,116		5,449	198,774
33		8,753	38	248,440			257,231
34		81		180,078			180,159
35				106,790			106,790
36				35,091			35,091
37				11,709			11,709
38		1,629					1,629
39							
40							
41							
42							
43							
44							
45							
46							
47							
48							
49							
50							
Total		569,843	91,319	1,243,518	38,845	506,716	2,450,241

October-December 2004: Anchovy (*Engraulis encrasicolus*), numbers in millions

Length cm	C. Cantin-C. Juby	C. Juby-C. Blanc	C. Blanc-C. Timiris	C. Timiris-St. Louis	St. Louis-C. Vert	C. Vert-Casamance	TOTAL
5							
6	12.7	9.8					22.5
7	25.4	259.7					285.1
8	146.3	565.6					711.9
9	366.9	4,239.4					4,606.3
10	487.8	2,868.3					3,356.1
11	1,380.3	676.5					2,056.7
12	1,127.4	219.0					1,346.4
13	227.7	7.2					235.0
14	22.9						22.9
15	4.4						4.4
16							
17	3.9						3.9
18	3.9						3.9
19							
20							
Total	3,809.7	8,845.6					12,655.3

Anchovy (*Engraulis encrasicolus*), biomass in tonnes

Length cm	C. Cantin-C. Juby	C. Juby-C. Blanc	C. Blanc-C. Timiris	C. Timiris-St. Louis	St. Louis-C. Vert	C. Vert-Casamance	TOTAL
5							
6	19	15					33
7	58	592					649
8	485	1,876					2,361
9	1,699	19,628					21,327
10	3,049	17,930					20,980
11	11,336	5,556					16,892
12	11,891	2,310					14,201
13	3,026	96					3,122
14	377						377
15	88						88
16							
17	113						113
18	134						134
19							
20							
Total	32,275	48,002					80,276

October-December 2004: Atlantic horse mackerel (*Trachurus trachurus*), numbers in millions

Length cm	C. Cantin-C. Juby	C. Juby-C. Blanc	C. Blanc-C. Timiris	C. Timiris-St. Louis	St. Louis-C. Vert	C. Vert-Casamance	TOTAL
5							
6							
7							
8							
9							
10							
11							
12							
13		2.5					2.5
14							
15	0.4						0.4
16	5.5	55.4					60.9
17	8.5	223.6					232.1
18	6.3	449.9					456.2
19	0.8	516.0					516.8
20	2.0	662.3					664.3
21	3.2	331.6					334.8
22	4.0	157.4					161.4
23	0.8	72.9	1.1				74.8
24	0.8	4.3	4.5				9.5
25		2.5	3.4				5.8
26		6.6	7.8				14.4
27			6.7				6.7
28			5.6				5.6
29			6.7				6.7
30	0.1		2.2				2.4
31							
32			2.2				2.2
33							
34							
35							
36	0.1			0.1			0.2
37	0.1						0.1
38				0.1			0.1
39				0.9			0.9
40	0.4			0.1			0.5
41	0.4			0.1			0.5
42	0.2						0.2
43							
44							
45							
46							
47							
48							
49							
50							
Total	33.5	2,484.9	40.3	1.4			2,560.0

October-December 2004: Atlantic horse mackerel (*Trachurus trachurus*), biomass in tonnes

Length cm	C. Cantin-C. Juby	C. Juby-C. Blanc	C. Blanc-C. Timiris	C. Timiris-St. Louis	St. Louis-C. Vert	C. Vert-Casamance	TOTAL
5							
6							
7							
8							
9							
10							
11							
12							
13		51					51
14							
15	8						8
16	133	2,091					2,224
17	245	10,067					10,311
18	216	23,929					24,145
19	32	32,138					32,170
20	92	47,928					48,020
21	171	27,681					27,851
22	244	15,063					15,307
23	56	7,945	139				8,140
24	63	526	632				1,221
25		343	535				877
26		1,028	1,400				2,427
27			1,341				1,341
28			1,244				1,244
29			1,655				1,655
30	18		610				628
31							
32			738				738
33							
34							
35							
36	31			53			84
37	34						34
38				62			62
39				539			539
40	127			73			200
41	137			78			215
42	98						98
43							
44							
45							
46							
47							
48							
49							
50							
Total	1,703	168,788	8,293	805			179,590

October-December 2004: Cunene horse mackerel (*Trachurus trecae*), numbers in millions

Length cm	C. Cantin-C. Juby	C. Juby-C. Blanc	C. Blanc-C. Timiris	C. Timiris-St. Louis	St. Louis-C. Vert	C. Vert-Casamance	TOTAL
5							
6							
7							
8							
9			10.3				10.3
10			12.8	5.9			18.7
11			214.2	35.5	11.8		261.5
12			272.3	59.0	18.1		349.3
13		44.1	167.4	70.2	13.9		295.6
14		115.3	24.1	58.3	16.8		214.5
15		49.1		56.1	3.9		109.0
16		103.7	10.3	39.0	1.1		154.1
17		463.4		0.8	2.2		466.5
18		785.8		3.8	9.0	3.2	801.8
19		959.3			17.8	1.6	978.7
20		1,067.2			10.0	14.6	1,091.7
21		953.9		2.5	6.6	37.6	1,000.6
22		683.1		5.0	5.1	84.6	777.7
23		542.6		22.5	5.3	164.3	734.8
24		201.8		20.0	16.1	108.7	346.5
25		172.4		8.8	10.9	43.7	235.7
26		109.8		10.2	12.8	14.4	147.1
27		136.7		1.3	4.6	4.4	147.1
28		207.3		0.1	3.7	3.3	214.5
29		41.4		0.2	1.8	1.7	45.1
30		46.6	0.3	0.9			47.9
31		25.9	0.7	0.8			27.4
32		10.4	0.3	1.5			12.2
33		5.2		0.6			5.8
34		5.2		0.7			5.9
35			1.1				1.1
36							
37							
38							
39			3.2	0.6			3.8
40			4.3	0.5			4.8
41			11.7	1.0			12.8
42			4.3	1.5			5.8
43			7.5	1.5			9.0
44			3.2	3.6			6.8
45			4.3	1.5			5.8
46				0.5			0.5
47			2.1				2.1
48							
49							
50							
Total		6,730.1	754.3	414.3	171.5	482.1	8,552.2

October-December 2004: Cunene horse mackerel (*Trachurus trecae*), biomass in tonnes

Length cm	C. Cantin-C. Juby	C. Juby-C. Blanc	C. Blanc-C. Timiris	C. Timiris-St. Louis	St. Louis-C. Vert	C. Vert-Casamance	TOTAL
5							
6							
7							
8							
9			85				85
10			142	65			207
11			3,128	518	172		3,818
12			5,105	1,106	339		6,550
13		911	3,954	1,658	328		6,851
14		2,953	705	1,705	492		5,855
15		1,535		2,004	139		3,678
16		3,911	444	1,681	48		6,085
17		20,863		41	116		21,020
18		41,792		233	546	197	42,767
19		59,749			1,268	115	61,132
20		77,230			823	1,204	79,257
21		79,636		238	628	3,587	84,089
22		65,358		546	557	9,249	75,709
23		59,155		2,798	666	20,472	83,092
24		24,927		2,818	2,278	15,341	45,363
25		24,011		1,405	1,730	6,948	34,095
26		17,157		1,816	2,281	2,574	23,828
27		23,882		268	913	888	25,950
28		40,315		25	824	738	41,902
29		8,937		56	447	409	9,849
30		11,112	90	248			11,451
31		6,801	198	239			7,239
32		2,988	109	488			3,585
33		1,636		206			1,842
34		1,787		269			2,056
35			458				458
36							
37							
38							
39			1,894	368			2,262
40			2,722	324			3,046
41			8,055	698			8,752
42			3,146	1,124			4,270
43			5,903	1,205			7,108
44			2,708	3,011			5,719
45			3,860	1,379			5,239
46				491			491
47			2,196				2,196
48							
49							
50							
Total		576,645	44,903	29,031	14,595	61,722	726,896

October-December 2004: Chub mackerel (*Scomber japonicus*), numbers in millions

Length cm	C. Cantin-C. Juby	C. Juby-C. Blanc	C. Blanc-C. Timiris	C. Timiris-St. Louis	St. Louis-C. Vert	C. Vert-Casamance	TOTAL
5							
6							
7							
8							
9							
10							
11							
12		2.0					2.0
13	5.1	0.7					5.8
14	5.1	5.0					10.2
15	54.3	10.8					65.2
16	771.5	57.7					829.2
17	1,680.1	142.7					1,822.8
18	1,306.6	128.9					1,435.5
19	643.7	55.1					698.7
20	191.5	43.2					234.6
21	137.6	79.7					217.3
22	217.3	68.8					286.1
23	168.7	59.8					228.5
24	124.0	66.1					190.1
25	34.4	46.2					80.6
26	42.9	24.4					67.3
27	37.4	59.0					96.4
28	40.1	125.7					165.9
29	41.6	156.3					197.9
30	13.4	69.1					82.5
31	4.0	48.6					52.6
32		13.3					13.3
33	8.1	3.8					11.9
34		4.3					4.3
35							
36							
37							
38							
39							
40							
41							
42							
43							
44							
45							
46							
47							
48							
49							
50							
Total	5,527.6	1,271.1					6,798.7

October-December 2004: Chub mackerel (*Scomber japonicus*), biomass in tonnes

Length cm	C. Cantin-C. Juby	C. Juby-C. Blanc	C. Blanc-C. Timiris	C. Timiris-St. Louis	St. Louis-C. Vert	C. Vert-Casamance	TOTAL
5							
6							
7							
8							
9							
10							
11							
12		32					32
13	106	15					121
14	131	129					260
15	1,700	338					2,038
16	29,112	2,175					31,288
17	75,636	6,423					82,059
18	69,492	6,857					76,349
19	40,090	3,430					43,520
20	13,856	3,123					16,979
21	11,488	6,656					18,144
22	20,791	6,582					27,373
23	18,390	6,518					24,908
24	15,320	8,161					23,481
25	4,798	6,431					11,229
26	6,713	3,808					10,521
27	6,530	10,313					16,843
28	7,799	24,452					32,251
29	8,976	33,699					42,675
30	3,196	16,471					19,667
31	1,059	12,756					13,815
32		3,823					3,823
33	2,548	1,212					3,760
34		1,498					1,498
35							
36							
37							
38							
39							
40							
41							
42							
43							
44							
45							
46							
47							
48							
49							
50							
Total	337,731	164,904					502,635